Skyways

Flight Operations • Engineering • Management

s NBAA—Story
tional Business
aft Association

•

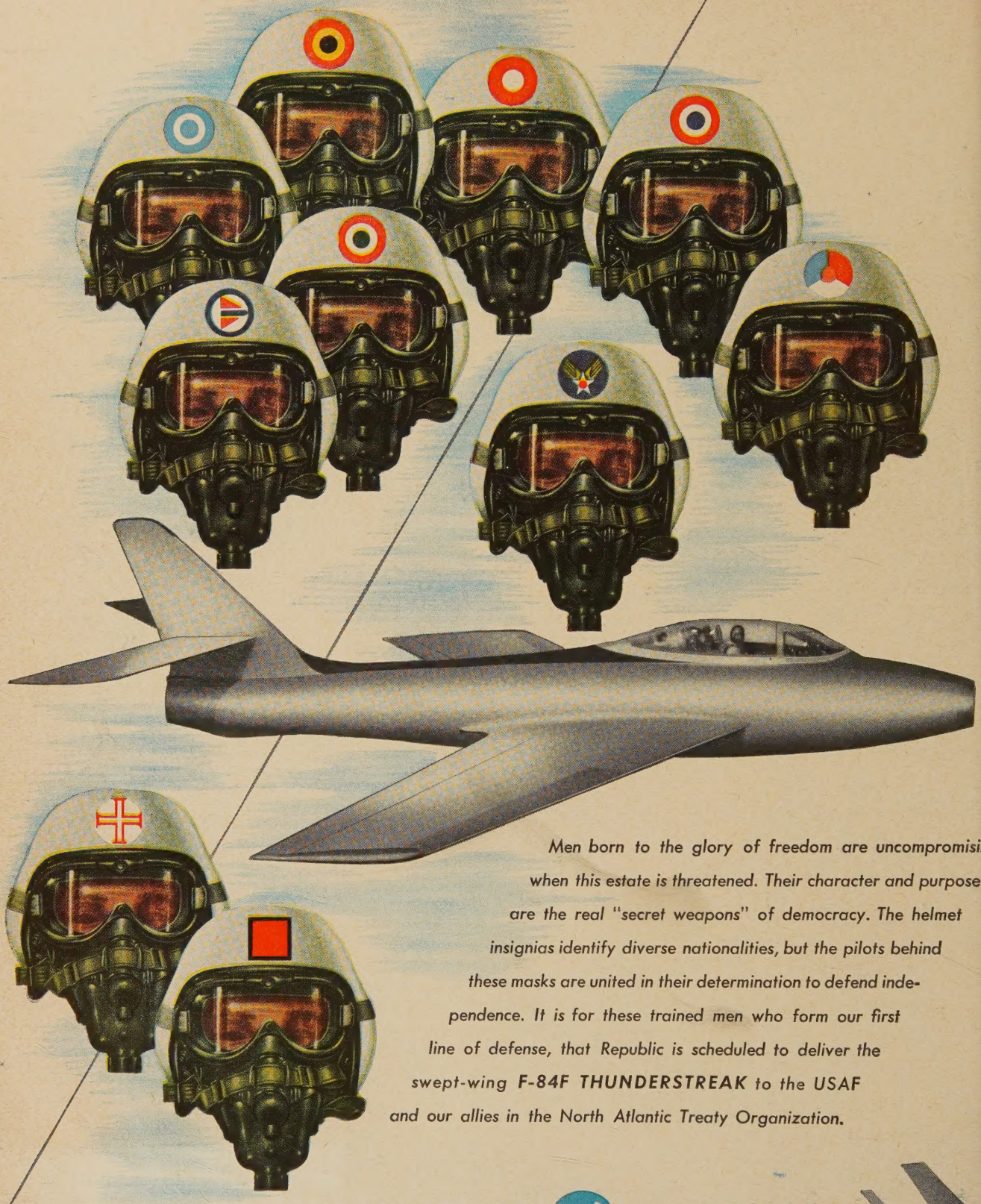
Safety for
Business Pilot

•

d Table: The In-
ce of Research
rcraft Operation

VEMBER 1953 50c

SECRET WEAPON . .

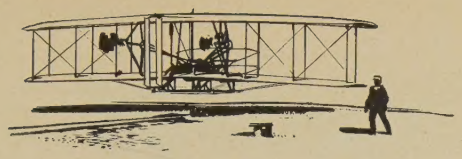


Men born to the glory of freedom are uncompromising when this estate is threatened. Their character and purpose are the real "secret weapons" of democracy. The helmet insignias identify diverse nationalities, but the pilots behind these masks are united in their determination to defend independence. It is for these trained men who form our first line of defense, that Republic is scheduled to deliver the swept-wing **F-84F THUNDERSTREAK** *to the USAF and our allies in the North Atlantic Treaty Organization.*

REPUBLIC AVIATION

FARMINGDALE, LONG ISLAND, N. Y.

Makers of the Mighty Thunderbolt · Thunderjet · Thunderstreak



FOR a few fleeting hours The World's Long-Distance Record for powered flight stood at 120 feet. The endurance time was twelve seconds, and the altitude—ten feet—was sheer high-flying madness.

What happened on Kill Devil Hill that chilly December morning fifty years ago still stands as the greatest milestone in the conquest of flight.

Even in this day, when the glittering flash of silver wings precedes the sound of their passage — all the proud achievements which have since swelled the log-book owe their existence to the men at Kitty Hawk.

Goodyear has played a consistent part in those entries: the first Aeroplane Tire, 1909, which served on early Wright bi-planes as they set new records; Stay-Tight Aeroplane fabric which gave new lift to their wings.

Then came the bullet-sealing fuel tank, the famed Single Disc Brake, the Cross-Wind Landing Wheel, Iceguards and many other Goodyear pioneering advancements.

Almost since the very year when events on Kill Devil Hill changed the world, Goodyear Aviation Products have contributed importantly to progress in the air.

Goodyear, Aviation Products Department
Akron 16, Ohio or Los Angeles 54, California

Iceguard—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

NOVEMBER, 1953

Skyways

Flight Operations • Engineering • Management

COVER: Business Aircraft at Williamsport, Pa. (Page 58)

FOUNDED BY J. FRED HENRY, 1942

EDITOR & PUBLISHER
Mrs. J. Fred Henry

MANAGING EDITOR
D. N. Ahnstrom

ART DIRECTOR
P. Nowell Yamron

ASS'T. PUBLISHER & ADV. MGR.
Bennett H. Horchler

EDITORIAL DIRECTOR
Franklin D. Walker

PRODUCTION MGR.
Stanley M. Cook

READER SERVICE MANAGER
Jack Galin

SKYWAYS is the authorized publication of the National Business Aircraft Association.

MEMBER AUDIT BUREAU OF CIRCULATIONS

VOLUME 12, NUMBER 11

SKYWAYS is published monthly by Skyways Publishing Corporation. Publication office; 1309 N. Main Street, Pontiac, Ill. Editorial and business offices at 444 Madison Avenue, New York 22, N. Y. Address all correspondence to 444 Madison Avenue, New York 22, N. Y. Mid-West rep., Robert W. Phelps, 3287 West 122nd St., Cleveland 11, O. Tel. Winton 1-6283. West Coast rep., Robert E. Ahrensdorf, 557 East Walnut St., Pasadeno 1, Cal. Tel. Sycamore 2-4119. Printed in the U. S. A. Single copy; 50¢. Subscription Prices: U. S. Possessions, Canada and Pan Am. Union, $9.00 for 3 years, $7.00 for 2 years, $4.00 for 1 year; all other countries add $1.50 per year for postage. Six weeks required for address changes (give both old and new). Manuscripts, drawings, other material must be accompanied by stamped, self-addressed envelope. SKYWAYS is not responsible for unsolicited materials. Entered as second-class matter, April 16, 1948, at the post office at New York, N. Y. under act of March 3, 1879. Application for transfer of second-class entry to post office at Pontiac, Ill. pending.

. . . now hear this

PERSONNEL

Robert L. Park has been appointed Assistant to Chairman Oswald Ryan of the Civil Aeronautics Board. **Joseph H. Fitzgerald** has been named Director of the CAB's Bureau of Air Operations.

Roy Backman recently was elected Vice President in charge of product sales of Pacific Airmotive Corporation.

Leon M. Wheatley is new vice president of the R. M. Hollingshead Corp., Camden, N. J.

A. M. Johnston succeeds John B. Fornasero as chief of flight test for Boeing Airplane Co. Mr. Fornasero requested his return to full-time piloting duties.

Rudolph F. Gagg has joined the executive staff of Bendix. He will assist Raymond P. Lansing in the administration of seven Bendix divisions. **R. G. Hoof** has been named Hydraulic Sales Manager of Bendix Pacific Division, and **H. D. Wilkinson** has been named Electronics Sales Manager, also of the Pacific Division.

Arthur Cruse, formerly General Manager of Aerodex, is new head of Lear Aircraft Service Division, including Grand Rapids and Santa Monica. **Bill Lear, Jr.,** recently returned from Air Force duty in Germany, has joined Lear, Inc. as a test pilot, and **William Wold,** aircraft broker, presently is assisting Bill Lear in closing sales for the new Lear Aircraft Service-modification, *Learstar.*

George J. Bindewald was named General Sales Manager of the Edison Instrument Division of Thomas A. Edison, Inc.

Frank Martin was appointed Sales Manager—Commercial Aircraft by Cessna Aircraft Co., and **Robert L. Lair** was made Director of Procurement.

Vice Admiral John B. Moss, USN (Ret.) has joined Bell Aircraft in a consulting capacity on a corporate basis. Adm. Moss will function between Bell's Niagara Division and the Texas Division.

Maj. Gen. Alden R. Crawford, USAF (Ret.) is now general manager of Republic Aviation International, S.A. Gen. Crawford's new base is at Lugano, Switzerland. **Walter G. Bain** has been appointed to the newly created position of executive assistant to the president at Republic Aviation Corp.

Whitney Collins is now chief engineer of Continental Aviation & Engineering Corporation's Gas Turbine Division, the present principal activity of which is the Turbomeca program.

Marvin J. Parks is now Customer Relations Manager on the staff of Air Associates' president J. E. Ashman. In the Aircraft Products Division, **Edmund B. Parke** has been named General Manager; **D. A. Morrison,** Sales Manager; **Charles Gaver,** Assistant Sales Manager; **Walter Stubbs,** Engineering Manager and **Raymond Hart,** Chief Inspector.

James B. Duke has joined Elastic Stop Nut Corporation as Technical Assistant to the General Sales Manager.

COMPANIES

General Electric Co. has announced the establishment of an Aircraft Nuclear Propulsion Department. **D. Roy Shoults** is general manager.

Seaboard and Western Airlines and the **Radiomarine Corporation of America** recently were elected to membership in the RTCA.

Trans World Airlines has doubled its order for Curtiss-Wright Dehmel Electronic Flight Duplications, making a total of 14 on order.

Garwin, Inc., has been licensed by The Sperry Gyroscope Company to manufacture all new parts required to modernize air-driven directional gyros and gyro-horizons stocked by Garwin.

Lockheed Aircraft has an Air Force contract to build prototypes of the XF-104 jet fighter.

Pratt & Whitney Aircraft has announced that their new J-57 turbojet powers the F-100 *Super Sabre,* a new jet fighter based on F-86 design but which offers many technical improvements over the *Sabre.*

AWARDS

Jerome Lederer, managing director of Flight Safety Foundation, recently was given the Arthur Williams Award. Presentation was made by Reginald M. Cleveland at a dinner at the Ambassador Hotel, New York City.

National Business Aircraft Association's annual Merit Award has been given to **Col. Charles A. Lindbergh** and those backers who made possible his "Spirit of St. Louis" flight to Paris in 1927.

AERO CALENDER

Oct. 22-23—RTCA 1953 fall assembly, Sheraton Park Hotel, Washington, D.C.

Oct. 23—NACA annual meeting, Illinois University Institute of Technology, at Champaign, Ill.

Oct. 29-30—NBAA annual meeting, Park-Plaza Hotel, St. Louis, Mo.

Oct. 30-Nov. 1—Executive Air Transport, Inc., Seminar. Pickwick Arms Hotel, Greenwich, Conn.

Nov. 3-4—1953 Transport Aircraft Hydraulics Conference, sponsored by Vickers, Inc. Hotel Park Shelton, Detroit.

Nov. 4-6—Society of Automotive Engineers meeting of Committee on aircraft hydraulic and pneumatic equipment, Statler Hotel, Washington, D.C.

Nov. 16-17—Aircraft Quality Control Conference, Biltmore Hotel, Dayton, Ohio

Nov. 17-20—Aviation Distributors and Manufacturers Association Eleventh Annual Meeting, The Jefferson, St. Louis.

Nov. 19-21—National Aviation Trades Assn., 14th annual convention, Hotel Broadview, Wichita.

Dec. 17—Seventeenth Wright Brothers Lecture, U.S. Chamber of Commerce Bldg., Washington, D.C.

Should the need arise again, the Cougar jet fighters above, plus other new Grumman Aircraft, will play as big a role in victory as did Panther jets in Korea . . . as did Grumman Wildcats, Hellcats and Avengers of task force fame in World War II.

GRUMMAN AIRCRAFT ENGINEERING CORPORATION

BETHPAGE • LONG ISLAND • NEW YORK

Grumman

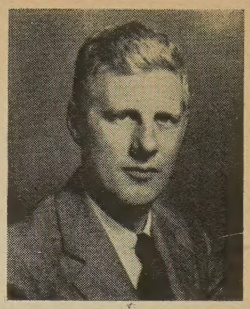
Watch for NBC's Victory at Sea on your local TV station

DESIGNERS AND BUILDERS ALSO OF THE ALBATROSS TRIPHIBIAN AND THE S2F-1 SUB-KILLER

by Franklin D. Walker

this is N B A A

National Business Aircraft Association recognized as a progressive force in advancement of aircraft utilization



PALMER J. LATHROP *was originator of idea that resulted in organization of CAOA, now NBAA*

In the history of aviation's first 50 turbulent years, few organization have done more to advance aircraft utilization and widen the frontiers of safe, dependable air transportation than the young National Business Aircraft Association.

The field it serves so well — business and industrial air operations — has recorded phenomenal growth since the end of World War II and that pattern of expansion will extend indefinitely into the future. The business aircraft is here to stay because it has become big business.

How big? For the benefit of the figger filberts and those who have not yet grasped the significance of business air activities, here are some startling facts:

Business aircraft plane-miles flown in 1952 — 37,000,000; passenger-miles flown in 1952 — 2,000,000,000; aircraft hours flown in 1952 — 3,250,000; number of business planes in operation — more than 10,000; average annual utilization of aircraft — 650 hours; business investment in aviation — $200,000,000 plus.

These figures fall into proper perspective when it is noted that the business fleet exceeds by many thousands that of all domestic scheduled airlines in the U.S., and that business aircraft last year topped the airlines in aircraft hours flown. And business aircraft are rapidly approaching the airlines astronomical plane-mile figure.

However, the use of aircraft in business might still be a small, struggling phase of aviation, if it were not for the vision and determination of a group of men who met at the Wings Club in the spring of 1946 to take a searching look at air operations. What they saw in those hectic post-war days was both discouraging and encouraging. On the bright side was a resurgence of flying — commercial, business and personal. The scheduled airlines were beginning a new period of expansion; independent nonscheduled freight and passenger operators sprang up on all sides, and business firms, remembering the utility of aircraft during the war, were turning to air transportation to meet the accelerating tempo of competition.

On the darker side of the picture, they saw airports and airways jammed beyond their capacity to handle the unprecedented volume of new air traffic. They saw, too, that the regulatory agencies were proposing drastic and even unwise measures to cope with traffic control problems.

The small group at the Wings Club was keenly aware that the interests of business flying would suffer in the scramble for air space and recognition because it was the only segment of the air operations industry not yet organized. The airlines had the ATA; the pilots had the ALPA; the independent freight lines formed their own group, and lightplane flyers were well served by the AOPA, the Civil Aeronautics Administration and the Personal Aircraft Council of the Aircraft Industries Association.

An organization to promote and protect the interests of business-aircraft operators was urgently needed and the first steps in that direction were taken by the Wings Club group during that informal session on May 17, 1946. A committee was appointed to plan a more formal meeting during the 1946 Cleveland air show and to invite prospective members from a wide geographical area.

The pioneering Wings Club group included representatives of Continental Can, Bristol-Myers, Johnson & Johnson, Time-Life, Manufacturers' Trust Company, Atlantic Aviation Company, and the Aircraft Industries Association. Credit for the basic idea — an organization of business-aircraft operators — is generally given to Palmer J. (Bud) Lathrop, then vice president of Bristol-Myers and now President of Cameron Machinery Company. He gained his knowledge of air-transport operations in the Air Force during World War II.

At the Cleveland air show, 30 aviation representatives of more than 20 corporations were on hand for the session which launched the Corporation Aircraft Owners' Association, now the National Business Aircraft Association. A tentative set of by-laws was adopted and a temporary board of directors appointed. On the board were representatives of Howes Leather Company, Sinclair Oil, General Motors, Bristol-Myers, Republic Steel, Champion Paper & Fibre Company, Goodrich Rubber, and American Rolling Mills. William B. Belden of Republic Steel was named chairman.

During the winter of 1946-47 monthly board meetings were conducted as the task of developing sound by-laws and preparing for incorporation went forward.

The organization was founded with 13 charter members and the first annual meeting took place in the Biltmore Hotel in New York on September 24, 1947. Officers elected at that time were:

Chairman, William B. Belden, Republic Steel; vice chairman, J. B. Mitchell, Howes Leather Company; secretary-treasurer, Palmer J. Lathrop, Bristol-Myers; and the following directors: D. S. Bixler, Sinclair Refining Co.; Paul C. Craig, Champion Paper & Fibre Co.; J. C. Guess, Burlington Mills; Walter C. Pague, American Rolling Mills; T. W. Hotze, Reynolds Metal Co.; and John R. Dunham, United Cigar-Whelam Stores.

With such mature, *(Continued on following page)*

serious-minded men at the helm, the new independent, non-profit organization set forth on its mission to represent and protect the aviation interests of its members; to present a united business-aircraft front in all matters where organized action became necessary to improve aircraft, equipment and service; and to further the cause of safety and economy of business-aircraft operations.

The NBAA has adhered faithfully to those objectives in the seven years since they were laid down as its guiding philosophy, and the result has been steady growth in membership, prestige and influence.

Early in its history, NBAA utilized every means to strengthen service to its members. One of the first such services was appointment of a technical committee to handle problems in aircraft, equipment, instrumentation, communications and navigation, and it has been of invaluable aid to members, to aircraft manufacturers, to distributors and dealers and many other agencies serving aircraft.

NBAA also has sought improvements in airways and airports, better weather service, expansion in communications and air navigation facilities, higher standards of airport services, improved aircraft parts distribution, equitable tax rulings for business-aircraft operations, greater recognition of the airplane as a necessary tool in modern business and industry, better tower and range station cooperation, and aircraft designed to meet the special requirements of business flying.

Wherever a problem in aviation related to some phase of business-aircraft operations is discussed, at least one member of NBAA can be found as participant or observer. NBAA is known and respected among federal and state aviation agencies, private technical committees and boards, and trade groups associated with the aeronautical industry.

Without fanfare but with quiet determination, NBAA has helped to bring about many improvements in facilities and services necessary to safe, dependable and economical business aircraft utilization. In several instances, business aircraft have become the first and biggest users of new navigational devices designed primarily for airline operations.

While many problems have been solved to the satisfaction of NBAA and business aircraft flying in general, one problem has remained since the organization was formed. It concerns aircraft designed and built for business aircraft users. Some progress has been made, but the business fleet now, as in the past, is mainly a collection of airplanes designed for other purposes. Most of them rolled off the assembly lines long before business flying became an important segment of air operations.

With notable exceptions, multi-engine aircraft plying the business skyways are modified versions of military combat and transport types or slow commercial types.

The backbone of the business multi-engine fleet today is the reliable Beechcraft 18. There are 625 now in operation. Next in line is the Douglas DC-3 which has the seating capacity desired by many corporations but falls short of their speed requirements. Another mainstay of business and industry is the Lockheed Lodestar. Plans are underway to give the plodding Lodestar a face-lifting conversion that will increase its cruising speed to about 300 mph at altitude.

To get decent cruising speeds, several companies have bought and modified such airplanes as the Lockheed Ventura, Martin B-26, Douglas B-23, North American B-25, Boeing B-17, Convair B-24 and Douglas A-26.

Of the post-war airplanes, the Aero Commander is a notable addition to the business fleet. Designed with the business operator in mind, the Aero Commander is a six or seven-place, low-wing transport with excellent single-engine performance, good cruising speed and better than average maintenance features.

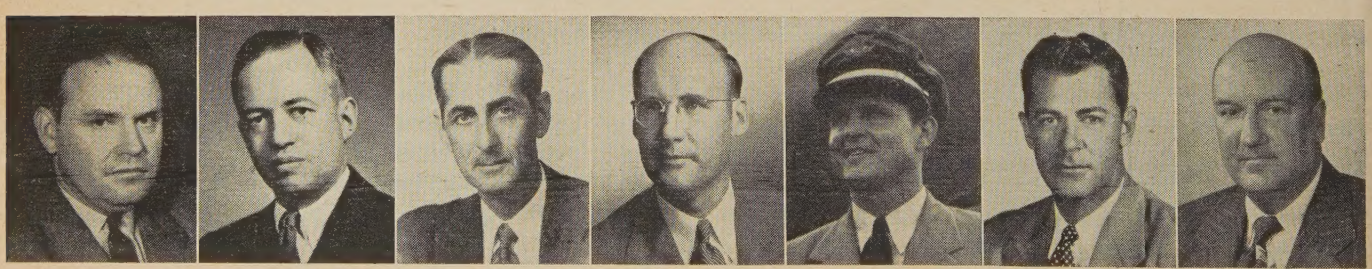
Another important addition to the business fleet is the de Havilland Dove, described by many pilots as the perfect small airliner. It is the first foreign-built transport to gain a foothold in this country, underscoring the post-war lag in U.S. production of needed new twin-engine equipment suitable for business usage. More than 75 *Doves* have been purchased by U.S. business concerns in the past two years.

Other new civil-type airplanes produced since the war include the Grumman Mallard, Convair 240 and 340, the Beechcraft Twin-Bonanza, the Twin Navion, Twin Cessna and Piper Apache. All of them are being fitted into the business aircraft market, because of its great need for many types of airplanes. However, business-aircraft operators are still seeking other executive types to round out their equipment. According to the results of a questionnaire among NBAA members, three executive-type aircraft are urgently needed. One would carry four-to-six passengers, such as the Aero Commander; another would be in the 6-to-12 category, and the third would accommodate 12 or more passengers. Sixty percent of those who replied designated the 6-to-12 as their choice, and 27 percent selected the 12-plus plane.

The cruising speed designated averages out at 256 mph, well above that of most executive aircraft now used, but a breakdown revealed these cruise figures according to aircraft categories: 4-to-6 passengers, 207 mph; 6-to-12 passengers, 256 mph; 12 or more passengers, 273 mph.

Ninety percent listed a preference for tricycle gear,

Board of Directors of the National Business Aircraft Association



Cole H. Morrow *Wm. B. Belden* *H. W. Boggess* *J. B. Burns* *W. C. Pague* *R. E. Piper* *E. T. Spetnagel*

77 percent want reversible propellers, 80 percent desire pressurization, and 73 percent want low-wing configuration.

In summarizing its findings, NBAA described the ideal executive aircraft as one that could better airline schedules and be large enough to include the best and most complete radio and navigation equipment. It should be capable of operating in and out of runways 2500 to 3,000 feet in length, have a ceiling above 20,000 feet and sell at around $225,000.

Whether aircraft in the several categories listed will be forthcoming is questionable. To meet the specifications, particularly in the 6-to-12 category, manufacturers would encounter re-tooling costs and difficulty in determining the size of the market for a particular airplane. And they believe that new aircraft above the 4-to-6 category would cost far more than most business operators are willing to pay. For example, one manufacturer estimates that a 12-place, 14,000-lb aircraft cruising at 300 mph would cost in excess of $20 a pound.

Regardless of the many obstacles on the road toward sufficient new airplanes of all types to meet the varying requirements of business operators, NBAA believes that they can be overcome as more business concerns add the airplane as a necessary tool in their day-to-day activities and as manufacturers become more cognizant of the impact of business on aviation.

It is gratifying to report that several aircraft manufacturers, aware of the needs of business aircraft users, are considering designs to meet specifications in the several categories pinpointed by the NBAA survey. The emphasis is on aircraft in the 6-to-12 category and in the 12-place and above classification, since there are sufficient aircraft in the four and 4-to-6 place category.

Strange as it may seem, NBAA has been compelled to conduct an educational program down through the years to "sell" itself as a representative of an important operational group in the aviation picture. Many persons within the industry were slow to grasp the significance and scope of business-aircraft operations, although it quickly became, and still is, one of the most stable segments of the nation's operational fleet.

Within the past six months, an official of a major airline remarked during a conference that only recently, meaning 1953, had he come to realize the extent of business-aircraft operations. Long before that statement, the number of business aircraft in operation far exceeded the total plying the domestic airline routes.

The roster of companies represented by NBAA reads like a "Who's Who" of American business and industry. It includes Monsanto, Dow, Celanese, Libby-Owens-Ford, Coca Cola, Sinclair, Shell, Standard Oil, Texaco, GE, RCA, Republic Steel, Bethlehem Steel, ARMCO, U.S. Steel, J. I. Case, Deere, International Harvester, International Paper, Champion Paper & Fibre, Burlington Mills, Minneapolis-Honeywell and General Mills, to name only a few.

These companies and hundreds of others have proved the practical value of the business aircraft and have found the airplane an indispensable aid in their daily operations. It permits the busy executive to go when and where he wishes in comfort and safety at a speed which can be translated into substantial savings in time and expense. It reduces his travel time and permits him to visit more places in a shorter period than is possible with surface transportation. And he knows that his airplane is many times safer than his own automobile. Business aircraft in 1952 established a safety record of less than 0.5% per 100,000,000 miles flown, although 70% of business flying was off airways and into all types of airports.

Business has obtained the best available pilots to supervise aircraft. And to the pilots, most of whom have had airline experience, goes much of the credit for the goodwill generated for business-aircraft operators.

The pilots have served still another highly important service, of which many of them may not be aware. Because most businesses using aircraft have never before had any association with the aircraft industry, except through air travel, their pilots have been the source of much valuable information concerning aviation. Through the pilots, business aircraft users have been given a liberal education in the problems of aircraft operations.

The story of NBAA's brief history would not be complete without mention of individuals who contributed much to the organizations formative years.

One was the late J. Fred Henry, founder of SKYWAYS, who had the vision to see the importance of the new group and to anticipate its steady growth and who gave his time and encouragement unsparingly in its embryonic period. It was Fred Henry, too, who provided the first office space for the young organization when it needed a base of operations. Subsequently, Fred Henry opened the pages of SKYWAYS to publish a monthly report of important items of interest to business-aircraft operators. The official report of NBAA activities still is an outstanding feature of the magazine in its coverage of the entire field of flight operations.

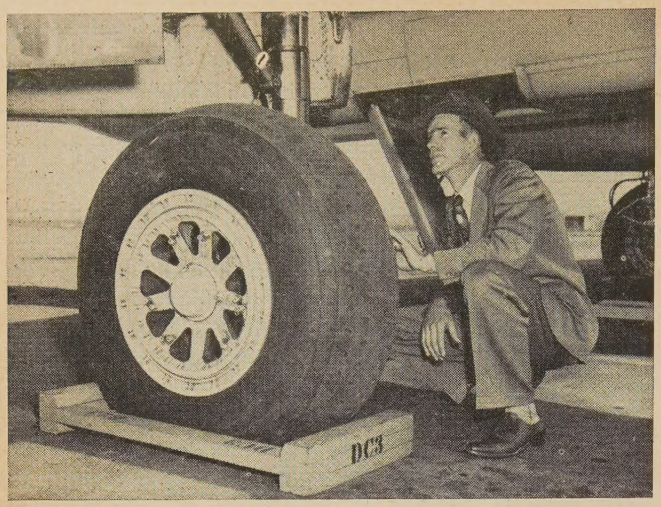
The NBAA also was fortunate early in its history in obtaining the services of the late Nathaniel F. Silsbee as executive secretary. He established the organization's national headquarters in Washington, D. C., and prepared the promotion material which helped to increase the membership. The job he did so well is now being carried forward by Jean H. DuBuque, executive director and secretary of NBAA and a former Air Force pilot.

The fact that many of the founders of NBAA still are actively identified with the organization is an important factor in the excellent continuity of its program. Included on that list are such men as William B. Belden, assistant counsel of Republic Steel Corporation, first chairman of NBAA and now a director; and Walter C. Pague of ARMCO Steel Corporation.

Another tireless worker since his company joined NBAA in 1949 is Cole H. Morrow, chief plant engineer of J. I. Case Company. A director of NBAA for several years, he is now serving his second term as chairman and outspoken champion of business-aircraft interests.

Other members of the current board of directors are Henry W. Boggess, Sinclair Refining Company; Joseph B. Burns, Fuller Brush Company; E. T. Spetnagel, Wolfe Industries; Mr. Belden, Ralph E. Piper, Monsanto Chemical Company; and Mr. Pague. Mr. Piper is also chairman of NBAA's Technical Committee.

If past experience can be used as an accurate guide to the future, the NBAA can look forward to years of steady growth and an ever-widening sphere of influence. Now seven-going-on-eight, the National Business Aircraft Association is a vigorous, articulate youngster recognized and respected as a progressive force in the fastest growing segment of aviation.



BUSINESS PILOT, *aware of his responsibilities, keeps close check on his aircraft. Here, Pilot H. L. McNeil looks over A-26 gear*

FLIGHT SAFETY for the Business Pilot

by Jean Du Buque
Executive Director, NBAA

Probably no subject is of greater concern to the business pilot than flight safety. The success or failure of aviation activities within business organizations revolves around the safety practices which are put into effect in daily flight operations. This point is vitally important since safety must be considered in connection with and not independent of the cost of securing it. In operating business-owned aircraft for executive and staff transportation, it is not sound judgment to carry on such an operation as a borderline affair.

Unlike some phases of air transportation, the decision to carry out a flight operation lies entirely in the judgment of the captain or pilot of the business airplane.

All passengers utilizing business aircraft must feel the utmost confidence in the pilot, gained only through riding with him and observing his ability, judgment and temperment through actual practices. If a landing is smooth, even though the trip was a rough one, there are those who honestly believe their pilot's ability approaches that of a superman. However, this type of air traveler is fast becoming passe. In this airminded age flying to most passengers no longer holds the mystery and thrill it did a few years ago. For example, one of the leading executives of a national corporation, who did very little flying until after World War II, has become a competent navigator. He has learned to recognize various cloud formations and what they indicate. He has become familiar with radio navigation and what it means to the pilot, as well as acquiring a general understanding of civil air regulations. This is the type of official that business pilots are flying daily.

The man at the wheel of the business aircraft is just as important to his company as the executive he is flying as a passenger. Naturally, most pilots feel this way about it, but they never overlook the trust and faith the company and passengers place in them. The fact that the lives of their passengers, as well as their own, depend upon their judgment and skill, makes business pilots highly safety-conscious. Consequently, insurance actuaries report that business-owned aircraft and pilots are the best risks in civil aviation today. There are important reasons why this is so.

First, aviation department personnel are hand-picked from experienced veterans of the field, whether they are flight or ground personnel.

Second, maintenance of aircraft and equipment follows an extensive routine. Cost of maintenance, although a somewhat sensitive subject since it figures substantially in the economy of an organization's operation, lays particular stress on the safety factor.

The extremely low accident rate of business aircraft is undeniable evidence of these facts. In 1952, the safety record was less than 0.5 for each 100 million passenger-miles flown. Such outstanding proof of safe flying and effective maintenance is particularly impressive when it is realized that nearly 2 billion passenger-miles were flown by these aircraft during that period.

Perhaps the next most important phase of flight operations to business pilots, after properly taking care of the maintenance factor, is flying the weather. Volumes have been written and will be written as to exactly how to handle this so-called "bugaboo."

From the standpoint of radio communication and instrumentation, business aircraft, particularly the multi-engine types, are among the best-equipped in the land. Airline pilots often marvel at the equipment carried in these business planes. Most business pilots are highly experienced and qualified for the most advanced type of radio navigation and can interpret the weather map and read the sequences. Consequently, on the surface, no flight should ever encounter really rough going. It's when the pilot sometimes feels so confident that he can conquer the elements that he takes off, only to realize later it was a serious mistake.

Business pilots should make it a point to cooperate with each other and with the Weather Bureau in reporting the weather enroute and any discrepancies between weather reported or forecast and weather actually encountered during the flight.

There is no half-way level in instrument flying. One

either does or doesn't do it. In that respect, the line is just as sharply drawn as between black and white, right and wrong, taxiing and flying. Even some of the old-time contact pilots kid themselves — but only themselves — when they barge into marginal weather imagining that they are flying semi-instrument, not knowing there's no such thing. Sooner or later, there will come the time when that marginal weather abruptly closes in or the ground suddenly comes up.

Bear in mind also that if the business pilot has not had an instrument check recently or flown actual instrument conditions for some time, as well as using the full equipment to do it, the boss could have taken the train, arrived late, and been done with it. Records of the CAB's Bureau of Safety Investigation bulge with grim reports of accidents caused by ignoring the just-mentioned fact. A good percentage of accidents were classed as "continuing visual flight into unfavorable weather."

Not all instrument weather accidents happen to novices in instrument flying. There was the case of a well-experienced business pilot who killed himself and three other people in one of the new aerodynamically clean airplanes which he could not handle in adverse weather. The crash report indicated that the aircraft was equipped with only the so-called primary flight instruments. Although this pilot was accustomed to flying a DC-3 on instruments, he couldn't fly the small plane with its bare complement of gauges.

The pilot who really knows the score and has everything he needs to work with still prepares for an instrument flight with a healthy regard for all hazards. He has available and may use innumerable aids — an able co-pilot, knowledge of weather changes, the best of instruments, an alternate airport, and often more than one engine. Even with all such preparation for an instrument flight, occasionally the pilot encounters difficulties that could prove of a serious nature.

It's always wise to know enroute minimums in advance rather than have to leaf through the CAA Flight Information Manual at the last second. Smart pilots won't let themselves be caught short when their time must be devoted to flying the airplane and keeping alert for other aircraft in the vicinity.

The CAA has on file a Master 511 for each major civil airport which indicates the F.I.M. minimums and the absolute minimums under which an instrument approach may be made. Qualified business pilots interested in obtaining authorization to make a let-down and landing when the sequence weather is below that listed by the CAA in the F.I.M. may obtain a Certificate of Waiver, ACA 663, from the CAA.

An application for the certificate of waiver may be submitted on Form ACA 400 to the nearest CAA Aviation Safety Agent. The application, detailing personal flight qualifications, and the communication and special equipment aboard the aircraft flown, is carefully considered. If this information proves satisfactory, a flight check is given by the agent to determine the applicant's competency and the adequacy of the equipment. If the examining agent decides that the applicant can safely make an approach and landing under the minimums requested, the file will be okeyed and submitted to the Regional Office for review and final approval. A flight check for each airport specified in the application for the certificate of waiver is, of course, absolutely essential under these CAA regulations.

So, to sum up weather flying, it's more often than not a matter of knowing one's capabilities and this is only gained through actual experience. But never over-estimate those capabilities.

NBAA members have piled up millions of passenger-miles without a passenger fatality. They are dedicated to flying on the safe side and preserving this outstanding record. The "secret" is exercising sound judgment and decision before and during flight operations.

Most business pilots file CAA Flight Plans for all flights. If not, what legitimate reason can be offered for not doing so? There have been many cases of lost aircraft because they were not on a Flight Plan. It's a fundamental flight procedure, yet there are some business pilots transporting top executive personnel over great distances using an occasional radio contact for weather as their only indication of position. Fortunately, this practice is not widespread among NBAA pilots.

The filing of Flight Plans is allied with the listening watch in control towers. The frequency used by itinerants often is not tuned to the same volume as airline frequencies, so pilots of business aircraft occasionally cannot raise the tower. If the tower watch were turned up, there would be more incentive for pilots to file Flight Plans because they could then call in from the proper number of miles out, using the approach control and tower frequencies. They then would be more likely to fly according to the Flight Plan instead of barging in and asking for immediate landing instructions.

Pilot inadequacy frequently is responsible for fatal accidents. The lessons learned from these accidents point sharply to the need for maintaining instrument proficiency, periodic training in emergency procedures, for operating within known limitations, and never risking a flight with malfunctioning equipment.

Behind some of these accidents there may have been

FLIGHT PLAN *is essential to safe operation. In this instance, Co-pilot Hendrickson, Pilot Shafer file flight plan at LaGuardia*

pressure on the pilot by the business-aircraft owner to take off regardless of risk, a situation which can cause the pilot much trouble, especially if he works for a domineering, self-centered "big wheel". In airline operation, both the pilot and dispatcher must approve each flight. The business pilot has no such safeguard. The supervisor of aviation operations often is not too familiar with safe-flying practices, being inclined to regard an airplane as simple to use as a car. The only remedy is to educate the boss. The pilot must prove to him that business flying is the most satisfactory and safest type of air transportation only when properly conducted. If the owner shows the same wisdom and judgment in the selection of his flight crew and the operation of his aircraft that has put him in a position to afford one, then the pilot should have little trouble from official pressure.

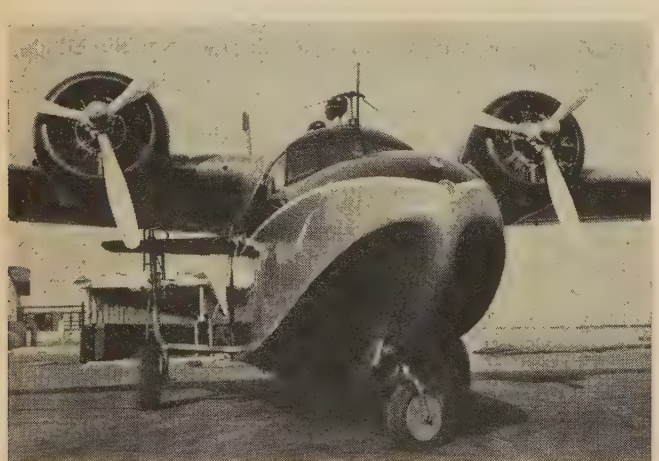
Owners never should use their influence to schedule a flight when in the opinion of the pilot the flight cannot be completed safely and in accordance with prescribed regulations. Nor should owners and executives insist on the crew drinking alcoholic beverages in flight or attending social parties if a flight is scheduled within the next 12-hour period.

Owners should firmly insist that all newly employed pilots be properly and recently checked out. This applies also to pilots who fly aircraft on a contract basis.

As previously pointed out, business aircraft generally are well equipped and excellently maintained. They are the best that can be bought and are modified to meet the rigid demands of safety. But in contrast to the maintenance of the airplane, owners often do not insist that the pilots maintain their proficiency. In this respect each pilot usually is his own boss and there generally is no one competent to judge the quality of his performance. The pilot, as a rule, isn't aware when he is slipping because "slipping" in the aviation business really is only standing still. If the pilot egotistically considers himself as good or better than he used to be, he thinks he's doing satisfactorily and makes no effort to check his proficiency. These pilots as well as their trusting passengers usually end up as statistics.

Generally, everyone in large business organizations, from the top executives to the janitor — is supervised by competent personnel. This can be applied to business-aircraft operation by either retaining the services of some professional organization specializing in flight refresher training, or arranging with the management of an airline to give pilots periodic checks. A balanced safety program for aviation operations should place as much emphasis on pilot maintenance as on aircraft maintenance.

BUSINESS AIRCRAFT *are among best equipped in the world. Many of them have Grimes light, like this one J. J. Ryan's Mallard*



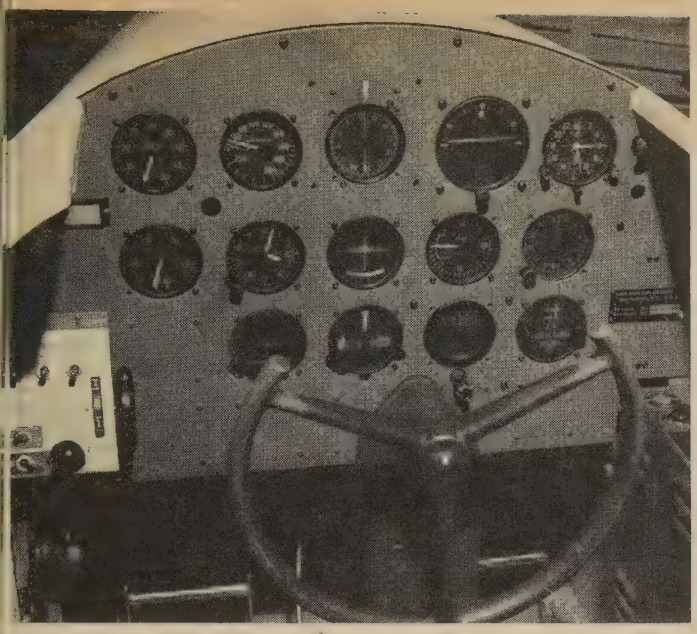
The manner in which this and other safety practices might be accomplished include:

1. Installing instrument flying hoods for use regularly enroute and for let-downs, with a qualified copilot checking and watching for other traffic.
2. Providing Link trainer facilities or making them available for the organization pilots. Giving due consideration to its drawbacks, it still is one of the best devices for practicing let-downs at strange airports and for monitoring the functioning of a pilot's mind.
3. Establishing standard cockpit procedures, including check lists, fuel logs, etc. Fuel consumption should be checked not once or twice per month, but every hour.
4. Prescribing weather minimums and perhaps field size minimums for organization pilots. (This may vary with the competence of the pilot.)
5. Arranging opportunities for pilots to ride in other aircraft and to frequently check one another.
6. Encouraging pilots to spend a minimum number of hours per month acting as observers of maintenance procedures so that they thoroughly understand what goes on when they push and pull gadgets. Where maintenance facilities are not available, the pilot must be capable of making necessary adjustments and ordinary repairs.
7. Urging qualified pilots to obtain an airline transport rating.

Operators of the 1800 multi-engined aircraft of the "Business Fleet" have always had the reputation for striving to remain ahead of the operating problems in this largest and fastest growing segment of civil air transportation.

Demand, however, is increasing for help to keep the professional business pilot abreast of the latest developments and at the same time maintain his day-to-day proficiency at top performance levels. To assist members in solving some of the problems pointed out, NBAA is developing a set of uniform standards for the flight crews of business aircraft. These standards can be applied to the operation of one aircraft or an entire fleet. They will cover routine operations, emergency procedures, air traffic procedures, crew coordination, navigational and instrument procedures and the analysis of performance characteristics of the various types of planes used by the operator. An up-to-date training manual for the type of aircraft flown is being studied and eventually may be provided for a nominal cost to each NBAA member-pilot as a part of the association service.

Almost without exception, pilots for business enterprises have a deep sense of their responsibilities and a pride in their professional knowledge and skills. Whether a company operates one plane or a fleet, the pilot is the active aviation manager, with complete charge and responsibility, enjoying and deserving the confidence of the business executives.



PANEL *in Link trainer incorporates standard arrangement of instruments as recommended by the Cockpit Standardization Committee*

REFRESHER TRAINING

Organized program of advanced training and periodic refresher now available to professional pilots flying U. S. industries' business aircraft

by John Creedy

In a suite of offices on the second floor of the Marine Air Terminal at La Guardia Field where great international airlines once dispatched their planes to Europe, Africa and around the world, pilots are dropping in to hear about a new kind of pioneering in the largest and fastest growing branch of the air transport industry.

The great four-engined international fleets have long ago moved to Idlewild and their places have been taken by the Twin Beechcrafts, Lockheed *Lodestars, Venturas,* DC-3's and the de Havilland *Doves* of the business aircraft fleets. The pilots who climb the stairs to the second floor are men who work directly for the industrial leaders of the nation. They contribute to the productivity of the nation's top executives by knocking down the barriers of time and distance. And, like their bosses, they are tops in their profession.

The businessmen who operate the corporation aircraft have long had a reputation for striving to keep ahead of the problems of their industry. The radio aids and instruments on their aircraft are the best available. Sperry sold 90% of the first year's output of the Zero Reader to the business fleets. Their planes were equipped with VOR long before many airlines placed orders for this latest radio navigational aid.

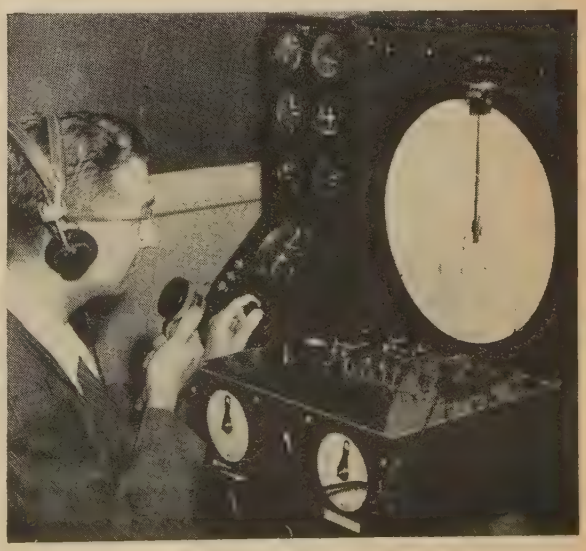
It comes as no surprise, therefore, that the industry should produce its own answer to a recognized need for an organized program of advanced training and, particularly, periodic refresher training for the professional pilots of this group. No government officials have moved into this picture with legal requirements. A private organization called Flight Safety, Inc., formed two years ago, has taken the first step in meeting this need.

Pilots are rightly among the most critical and conservative of any professional group. They must daily stake their lives on the correct evaluation of variable information. Planes never do quite what the book says. And, of course, the cold front due over Pittsburgh in the late afternoon often comes barrelling in at noon. It's natural, therefore, that pilots dropping into the offices of Flight Safety, Inc. out at LaGuardia Field, ask a lot of questions, partly because of their ingrained skepticism.

Its President, Captain A. L. Ueltschi, founder, of this organization and a business pilot himself, understands this skepticism. Useltschi's background is the key to this program. He is the personal pilot for the president of one of the nation's largest scheduled airlines. His problems have been the same as almost any other business pilot's but he has had one advantage. He has been able to use the airline's training and refresher program and knows first hand its value. But, he also insists that a program set up for airline pilots, though useful, falls a long way short of meeting the real needs of the business group. "The problems we face are not the same and I was convinced that, as the business fleets expanded there would have to be a separate answer", Ueltschi says.

It was not easy to find the answer. "A lot of people think that you can keep a pilot *(Continued on page 46)*

KEY ITEM *of ground equipment is Link trainer fitted with a Dehmel radio aids unit (below) for radio navigation practice*



CONTRACT OVERHAUL OF BUSINESS AIRCRAFT

General and detail specifications serve as a guide to contractor as well as plane owner, and help to keep tight rein on overhaul costs

by W. L. Nye

The overhaul of air transports is expensive to business-aircraft owners. Therefore, in order to keep the cost of overhaul operations within reasonable limits, it is to the owner's advantage that definite specifications be presented to prospective bidders for the work so the bidders will know exactly what is expected of them. Similarly, this permits the aircraft owner to select the best price commensurate with the work to be accomplished within the time limit specified.

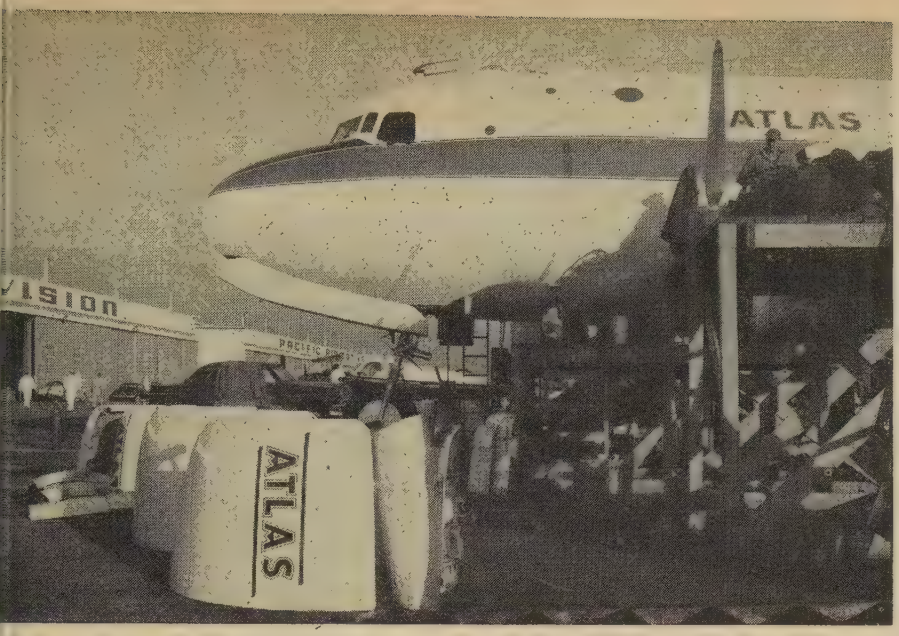
Normally, competitive bidding by overhaul firms shows wide variations in anticipated costs, thus confusing the plane owner. The only other recourse is to determine the anticipated overhaul cost on a time-and-material basis. This is fraught with danger, however, to the business-plane owner because he is generally at the mercy of the firm accomplishing the work. In this aviation repair business, as in other businesses, there are good firms and bad, efficient organizations and inefficient organizations. It is to the business-aircraft owner's advantage, therefore, to present definite work specifications so that when the job is completed the costs will not be out of bounds, nor will charges for any extra work be extravagant. Because it is difficult to accurately assess the cost of overhaul work in advance, the more reason why precise work specifications are necessary. For example, upon award of the overhaul work to a specific firm and in the course of the preliminary inspection by that firm's project engineer and inspector, certain controversies may arise as to the justifiability of doing certain work. The precise work specification not only serves as a guide but implements the work to be accomplished without controversy or lost time in discussing such items with the company-plane owner's representative. This is the reason why detailed work specifications are essential to control costs.

The work specs usually are divided into two categories: (1) the general stipulations incidental to transfer of custody, handling the airplane, the preparation for overhaul, warranty, etc., and (2) those that outline certain basic technical specifications descriptive of the work to be done. The degree of preciseness with which these work specs are compiled will be reflected in lowered over-all costs of the overhaul operations.

General Work Items: Perhaps the most important of these items is that covering the warranty of workmanship. The overhaul contractor should guarantee that all work will be done by licensed mechanics, inspected by licensed inspectors who sign and approve each item of work, and be free of defects in either workmanship or installation. The contractor's obligation should apply for 30 calendar days or 50 flying hours after acceptance and delivery of the completed airplane to the owner. It should be agreed that the airplane will be returned for rework if any failures develop and that the cost of this rework will be borne by the contractor. The sole obligation of the contractor under this warranty is for the overhaul, repair, or installation of equipment. Conversely, the corporate owner of the airplane should agree to hold the contractor free from any and all claims, damage, expense or loss which may arise by reason of the work performed, other than claims for repairs to overcome defective workmanship. All claims for rework must be made in writing within the time limits specified. After acceptance and delivery of the aircraft, the contractor should not be liable, without prior written consent, for the repair or replacement of any defective work or part which may be performed by a source other than the contractor.

The overhaul contractor makes no warranty on functional accessory parts supplied by vendors, and the sole warrantability of these parts will be those of the vendor, provided installation has not been at fault. The warranty is not applicable to customer-furnished equipment or parts, but is applicable to the installation of those items supplied by the contractor. The contract work specification should be mutually agreed in writing and should not be altered or varied except by written mutual consent of both principals. Also, the contractor for this work must be approved under the CAA Approved Repair Station Certification.

Contract Cancellation: The overhaul contract can be cancelled by either principal on proper written notice, provided the contractor is reimbursed by the aircraft owner for the pur-



OVERHAUL *warranty included in contract guarantees that all work will be done by licensed mechanics and also inspected by licensed inspectors*

chase of tools, parts, or materials required to do the work specified. Costs arising from the work in progress when the cancellation is given should be negotiated on a mutually pro-rated basis.

Insurance Protection: In order to protect the customer, the overhaul contractor should provide adequate insurance to cover the loss of any transient airplane in his custody. The insurance should cover fire, wind damage, physical damage, and theft.

Custody of the Aircraft: Also in order to safeguard the plane owner, the contract should stipulate that custody of the plane is transferred to the contractor upon its arrival at his facility. The contractor's chief inspector should receive custody of the airplane and give a receipt to the owner.

Drainage of Gasoline: All gasoline drained from the aircraft's fuel tanks should be accountable and a credit issued to the customer for the amount of gasoline at the current price per gallon. The gasoline should be drained after the initial preliminary inspection run-up of the engines and preservation has been accomplished.

Keys: All aircraft keys should be transferred to the chief inspector upon the plane's arrival at the contractor's plant. After the overhaul is completed, all locks and keys should be checked for proper operation prior to plane departure and the keys transferred back to the owner on acceptance and delivery of the overhauled airplane.

Airplane Records: Airplane historical records should be transferred to the contractor's Inspection Office upon arrival at his plant. A signed receipt should be requested to assure accountability. Aircraft historical records should be posted and revised prior to delivery of the airplane after overhaul. Airworthiness Directive Items of the CAA should be noted as to compliance.

Release of Technical Data at Completion: Upon completion of the overhaul work and the acceptance test flight by the owner's representative, all technical data dealing with the contract should be supplied to the owner, and this should include a revised weight and balance report. The weight and balance report should be authenticated by the project engineer and certified as accurate by the chief inspector.

Customer Furnished Materials and Parts: It should be specifically determined and mutually agreed which material and parts are to be customer furnished. These parts then should be supplied f.o.b. the contractor's plant.

Replacement of Serviceable Parts: Where the original parts are to be overhauled, the usual quality control standards must be maintained for the inspection of all plane parts for serviceability prior to repair. As far as possible, these same parts should be reinstalled on the customer's airplane.

Reconditioning of Loose, Detachable, Equipment: Upon the aircraft's arrival at the contractor's plant, all loose, detachable, or emergency equipment should be removed by inspection personnel, and a receipt of accountability given to the owner's representative. This equipment must then be repaired or replaced as per the inspection discrepancy reports.

Contractor-Furnished Miscellany: The overhaul contractor should agree to furnish the required shop facilities, shop tools, indirect materials, and plant equipment for performance of the contract. Hardware items and indirect materials should be pro-rated in cost as a percentage of the direct labor man-hours expended in performance of the contract. Indirect labor man-hours expended will be charged to the customer on a percentage basis agreeable to both the plane owner and the contractor.

Residue and Salvageable Materials: All damaged residue materials and parts should be credited to the customer's account as is, or if the customer wishes to have damaged materials repaired, the contractor should agree to submit an estimate of the cost of such work. Standard direct hourly rates will prevail. Nonusable material should be listed for the customer, and authority for its disposition remains the customer's. Customer material or parts intended for shipment to addresses specified by the customer will be packed and crated at prevailing labor and material costs and salvageable materials, when sold, should have the full amount credited to the customer's account.

Weight and Balance Report: The overhaul contract should assure the plane owner that the true C.G. for the airplane will be determined only by electronic weighing methods. Certain items of equipment, however, may be estimated for weighing purposes.

Patent Protection: In performing any special work in conformity with the customer's requirements, the contractor should not be held liable for any patent infringement.

Subcontract Work: The contractor must obtain the customer's approval before any work, such as engine or propeller overhaul, may be subcontracted. When subcontracting of overhaul work is required, the standards of workmanship, performance, and inspection must be in accordance with the CAR requirements and must be done in a CAA-approved repair shop.

(Continued on following page)

CONTRACTOR *installs new serviceable parts as per contract requirements and upon approval by the customer who should be given duplicate requisition, purchase records, etc.*

Policy on Serviceable Parts: Upon approval by the customer, serviceable parts supplied by the contractor on an exchange basis may be reinstalled, or new serviceable parts installed as per contract requirements.

Customer-Furnished Equipment Storage: Customer-furnished equipment storage must be provided in a secured area. Complete accountability should be maintained at all times, and records made available for inspection by the plane-owner's representative.

Customer Audit: All work performed on a time-and-material basis should be audited by the customer's representative to check expenditures. The customer should be supplied with duplicates of the accounting records, time cards, requisitions, and purchase orders expended against the contract.

Ferry Flights and Flight Tests: The contractor and the customer should agree on the cost of ferry flights for delivery of the airplane, plus servicing costs. The customer must not be charged for more than two test flights, and any test flights in excess of this should be at the contractor's expense. The duration of the test flights should not be over one hour.

Inspection Quality Control: Inspection quality control standards must be in compliance with approved CAR requirements as well as the contractor's inspection and process specifications. This data should be made available to the customer on demand.

Inspection Discrepancies: Inspection discrepancies written by the contractor's inspectors must be approved by the customer's representative in writing, prior to the issuance of instructions to perform correction operations. Duplicate copies of the inspection reports will be made, and inspection discrepancies written in compliance with the CAR.

Fly-Away Servicing Prior to Delivery: All loose items must be properly packed and stowed in their assigned positions in the airplane. Fuel, lubrication oil, anti-icer fluid, carbon-dioxide gas, compressed air, hydraulic fluid, lavatory and galley supplies will be charged to the customer at prevailing rates.

Taxes: Where applicable, sales taxes will be charged only on materials which are purchased for installation on the airplane.

Contract Revisions: All revisions to the basic contractual obligations must be mutually agreed to by both principals. Customers desiring specific changes to engineering specifications should make this known in a formal written request. Amendments can then be issued against the basic items covered in the contract.

The above-mentioned general items constitute the preamble to the technical work specifications usually referred to as the Engineering Work Statement. The following are general policy items to be followed on detail overhaul work items.

Engineering Work Statement: Either prior to or upon award of the work to the contractor, an engineering work statement should be prepared and submitted to the customer for approval. This should cover those items which are mandatory, such as Airworthiness Directive Items, the items which the customer wishes to be accomplished, the range of inspection discrepancy items, engine preservation, engine run-up checks, engine removal, etc. These specifications are agreed to constitute the basic work to be done, plus those found necessary by preliminary inspection. This engineering work statement should constitute the basis on which purchasing and production orders are issued.

After the finalized engineering work statement has been issued, an anticipated man-hour expenditure estimate should be submitted to the customer for approval. This should include work on those items found in need of work in prelimary inspection. Thus, items of overhaul, parts repair, parts replacement, fuel tank resealing, airworthiness directive items, special request items, etc., should all be included. Work found to be necessary after disassembly would be covered by the issuance of an approved amendment. Amendments to the basic overhaul items would cover those items that affect compliance with the CAR, performance, or comfort of the crew or passengers.

Radio Equipment: All radio equipment should be checked for proper operation. It should be calibrated for accuracy on the test flight.

Range Marking of Instruments: All instruments should have the operational range marks checked.

Decalcomanias or Placards: All placards should be checked for proper wording and legibility.

Identification Marks: Identification marks and numbers should be restored in compliance with the CAR. The same applies to insignia. Stencil patterns should be used wherever possible. Touch-up of these items is permissible when customer-approved.

Preliminary Inspection: The preliminary inspection should be made after the airplane has been cleaned.

Cleaning Operations: The airplane should be cleaned by means of steam cleaning, solvent cleaning, or vapor degreasing wherever required. Engines should be cleaned by air jets and solvent sprays.

Stripping of Damaged Painted Areas: Where painted areas have been damaged or are deteriorated, these should be stripped by chemical strippers prior to repainting.

New Painting: New sheet metal parts should be primed with zinc-chromate primer or made from pre-primed

(Continued on page 40)

Flying the ADIZ

by Capt. H. R. Van Liew

United Air Lines

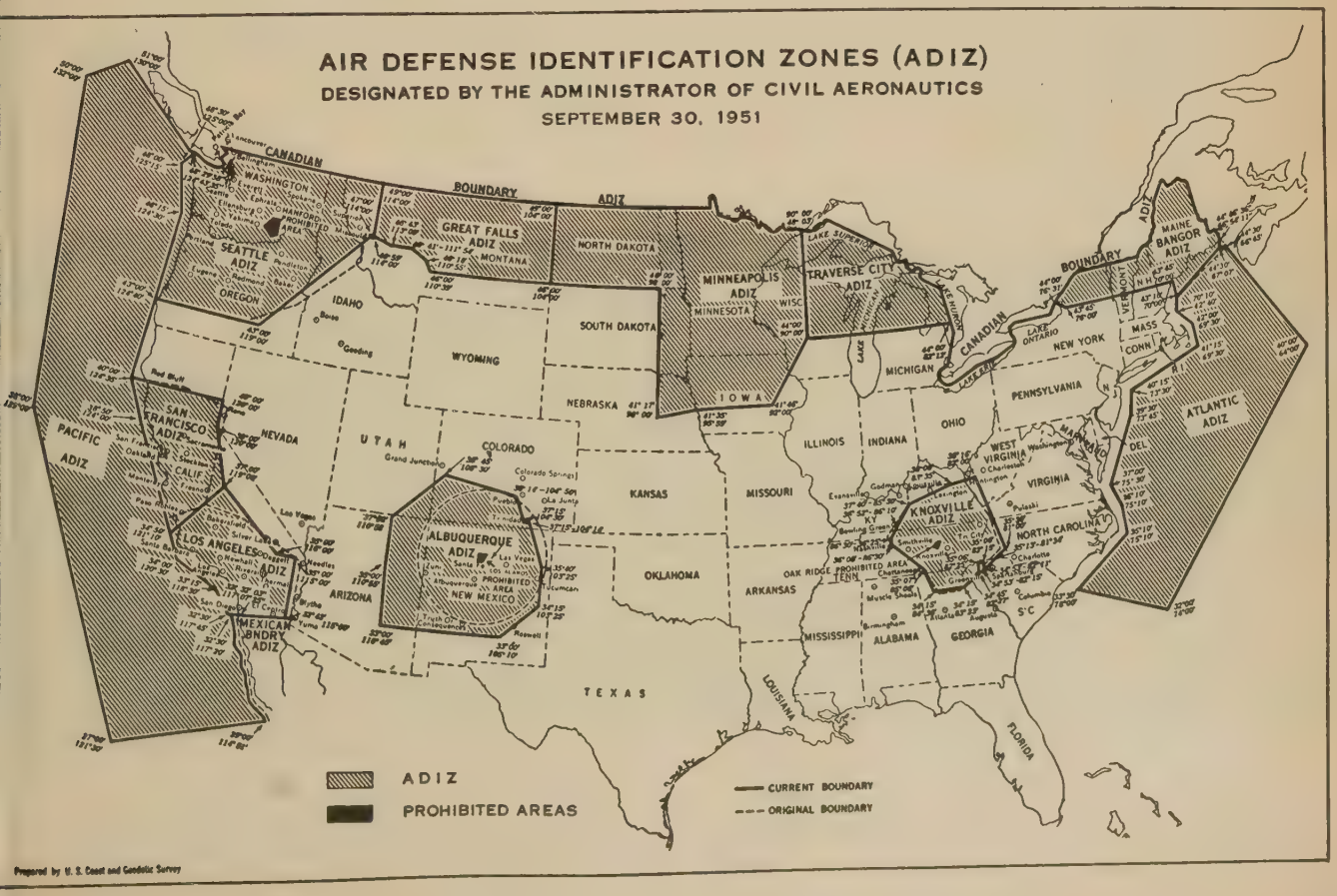
For some reason there still seems to be a question in the minds of many pilots regarding procedures for ight into and through the Air Defense Identification ones. Taking first things first in this business of flying n ADIZ, it probably would be wise to have an over-all ook at the areas in the United States where the ADIZ re located.

Starting up the West Coast from a point below San iego *(see map)* and extending some 50 miles north of os Angeles and inland for 200 miles, we have the Los ngeles ADIZ; adjoining that and proceeding to a point bove San Francisco is the San Francisco ADIZ. Follow- ng an open area of some 200 miles (from Red Bluff to lamath Falls) is the Seattle ADIZ which reaches north the Canadian border. West of these local areas we have ne over-all Pacific ADIZ.

Heading East and adjoining the Seattle ADIZ is the reat Falls ADIZ, then the Minneapolis ADIZ which rops south to a po nt near Des Moines, Iowa, the raverse City ADIZ, and the Canadian border boundary area to the Bangor, Maine, ADIZ, and south of that, the Atlantic ADIZ.

In the southwestern section of the United States we have the Albuquerque and Los Alamos area ADIZ, and the Knoxville Ridge Air Defense Identification Zone. Within certain of these defense zones, specifically at Oak Ridge (Knoxville ADIZ), Los Alamos (Albuquerque ADIZ) and Richland (Seattle ADIZ), there are prohibited areas within which no aircraft can be flown except by special permission of the U.S. Atomic Energy Commission.

Perhaps to appreciate the necessity of following procedures for flying the ADIZ, a pilot should understand the zone set-ups. In each of the ADIZ there is an integrated Information Center to which word of all aircraft in flight is sent by Air Traffic Control, the radar networks and civilian spotters. Filter centers compile this data as it is received and markers, representing all planes in flight within the respective zones, are placed on an operations board. If an aircraft entering *(Continued on page 50)*



Relationship of Research to Aircraft Operations

Discussion discloses need for helicopter criteria, also more systems engineering and simulation testing to help shorten time of air transport's evaluation phase

Moderator William Littlewood *(Vice President Engineering, American Airlines):* "To examine the relationship of research to current and future aircraft equipment and operations, SKYWAYS has brought together a representative group — some are on the staffs of research agencies; others are manufacturers and operators; and some are from the military services and government agencies that work with the manufacturers and the operators. Certainly, much understanding should come from a meeting such as this.

"As an opening to the discussion, let's define research. I have here an article on science and technology authored by Dr. C. C. Furnas, Director of the Cornell Aeronautical Laboratories. In this article, Dr. Furnas says, 'Research means the exploration, by whatever means, of the ways or laws of nature and the application of the findings to some specific objective.'

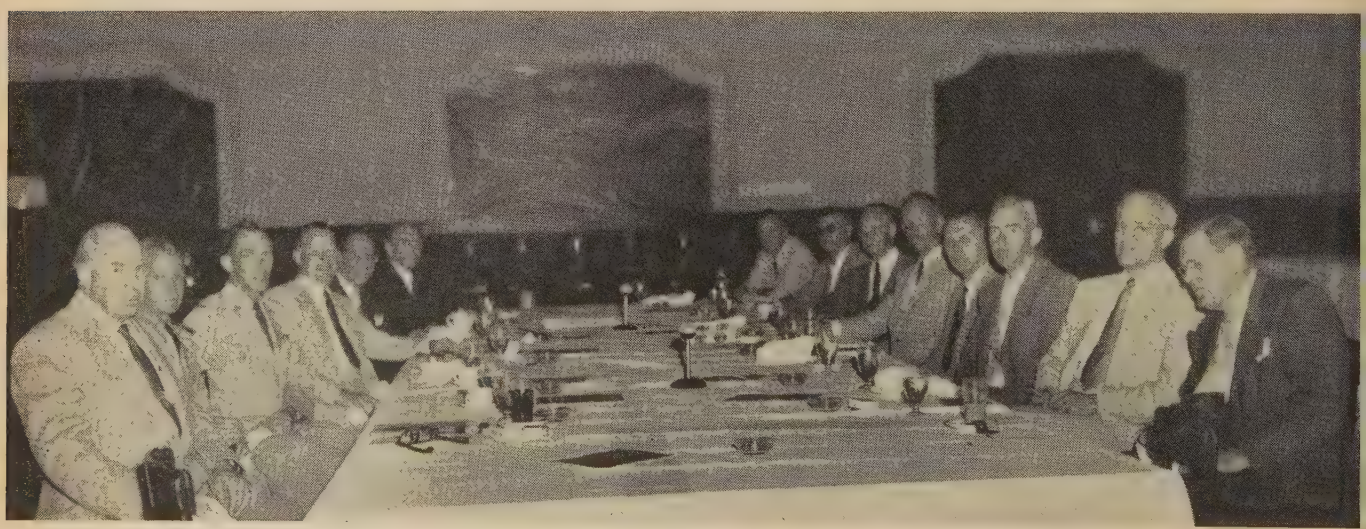
With that definition, gentlemen, I'm going to turn to our researchers and ask them what they think research is."

Dr. Hugh L. Dryden *(Director, NACA):* "The word 'research' has come to cover a wide range of activities, all the way from basic research to the work carried on by engineers in the plants to develop a 'fix' for some trouble. In purely basic research, we are trying to understand phenomena without any particular regard to application, as for example when we study flow in a boundary layer and try to find out something about heat transfer and the distribution of velocity through it, or the conditions under which it separates. This work is done most effectively by individuals in small groups in universities and to a more limited extent in the larger organizations. While we do some work of this kind in the NACA, it is a relatively small part.

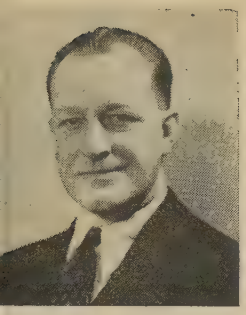
"Another sub-division of research is what we call applied research, for example, trying to discover how the efficiency of air inlets varies with systematic changes in their geometry.

Mr. Littlewood: *"Dr. Millikan, could you give us a brief summary of who does research in the aeronautical field in this country?"*

Dr. Clark B. Millikan *(Dir., Guggenheim Aeronautical*



RESEARCH *authorities who participated in the Round Table were (left to right) L. D. Webb of the AIA; Capt. E. M. Condra, Jr., USN; Col. D. H. Heaton, USAF; William Littlewood of American Airlines; Mr. Horchler of Skyways; W. R. Ramsaur of AiResearch Mfg.; Mr. Simpson; William P. Lear of Lear, Inc.; A. E. Raymond, Douglas Aircraft; Dr. Clark B. Millikan of Cal Tech; Dr. Dryden of NACA; J. S. Marriott, CAA; M. G. Beard of American Airlines; C. M. Belinn of Los Angeles Airways*



WM. LITTLEWOOD, *who served as Moderator, joined American Airways in '30, became Chief Engr. in '33. Company became American Airlines in '34; he was elected Vice Pres.-Engr. in 1937.*

Lab., CIT): "There are a number of different groups that work on research problems. The first in scope and magnitude are the various government agencies of which Dr. Dryden's Committee makes the largest contribution. However, there are a number of other government laboratories that have grown out of the bureaus of the Navy, the Air Force and the Army in the past few years, and these also make contributions to basic research.

"I think it is more difficult to provide the environment for pure and basic research in large government laboratories than it is in some of the academic institutions which historically have been the source of many contributions to such research. It has always seemed to me that some of the most important advances in fundamental knowledge have come when an entirely different discipline is applied to the problems on which one is working. For example, the entry today of people with aeronautical and engineering training into astronomy is bringing about extraordinary advances and changes. Similarly, aeronautics has benefited by getting physicists and chemists interested in propulsion and combustion problems. This is one of the fruitful ways in which basic knowledge is developed."

Mr. Littlewood: *"In other words, you never can tell where research may lead."*

Dr. Dryden: "While basic research is done without regard to application, that does not mean that basic research cannot be applied. This is largely a matter of time scale. The basic research of today will greatly influence applications 10 or 15 years from now, just as applications today are influenced by basic research done 15 or 20 years ago. Basic research will be applied — eventually.

"The Secretary of Defense defined basic research as 'the kind of research that brings no benefit to the man who pays for it.' This is technically accurate. The investment in basic research today brings its benefit to future generations. Today, we are living on what other people paid for years ago."

Mr. Littlewood: *"Is it true, Capt. Condra, that in general the services are more interested in development and the application of research than in basic research?"*

Capt. E. M. Condra, Jr. *(Cmdr, Naval Air Missile Test Center, USN):* "I'd like to correct that statement somewhat. The services are more concerned with testing and evaluation than they are *(Continued on following page)*

SKYWAYS FLIGHT OPERATIONS ROUND TABLE

NOVEMBER 1953

Hollywood-Roosevelt Hotel, Los Angeles, Cal.

Round Table Participants

L. D. WEBB, Vice President and Western Regional Manager, AIA, is a Captain, USN (Ret.). He holds Master of Science degree, Aeronautics, from MIT and is a member of the Institute of Aeronautical Sciences.

WILLIAM P. LEAR is Chairman of the Board and Director of Research and Development of Lear, Inc. In 1940 he was awarded the Frank Hawks Memorial Award; in 1950, he was awarded the Collier Trophy.

W. R. RAMSAUR, Vice President-Engineering, AiResearch Mfg. Co., joined the company in 1939. He is a graduate of Davidson College and MIT, and began his engineering work at GM Research Lab in '27.

ARTHUR E. RAYMOND began his career at Douglas Aircraft in 1925, became Chief Engineer in '36 and Vice President in charge of engineering in '39. He is a graduate of Harvard and MIT; is member of NACA.

CAPT. E. M. CONDRA, JR., USN, is graduate of Naval Academy; was designated Naval Aviator in 1930. He received his aeronautical engineering degree at Univ. of Mich.; is now Cmdr., USN Air Missile Test Center.

JOSEPH S. MARIOTT, Administrator, Region IV, CAA, has been associated with Civil Aeronautics Administration since 1928. He served in both World War I and II and still possesses Command Pilot rating.

DR. CLARK B. MILLIKAN, Director of Guggenheim Aeronautical Laboratory, has been a Professor in Aeronautics Dept., Cal Tech, since 1940. He is Honorary Fellow of IAS and a Fellow of RAS of Great Britain.

DR. HUGH L. DRYDEN, Director of the NACA, is a graduate of Johns Hopkins Univ. He is a member of the Committee on Aeronautics of Research and Development Board and the Naval Research Advisory Committee.

M. G. BEARD, known to all as Dan Beard, learned to fly at Kelly Field, Texas. Before becoming Chief Engineer, American Airlines, he was Chief Engineering Pilot, then Director of Flight Engineering, AAL.

C. M. BELINN, President of Los Angeles Airways, organized the company in 1944. His was the world's first scheduled helicopter service. Mr. Belinn began his aviation career in the Army Air Corps in '25.

COL. DONALD H. HEATON, USAF, is Director of Aeronautics and Propulsion, Hq., Air Research and Development Command. A graduate of West Point (1941), served with Heavy Bombardment, 8th AF during WW II.

"PEOPLE, *both in CAA and industry, feel that additional service testing of transports is justified," reported J. S. Marriott of the CAA*

with development. We try to avoid competition with those areas of industry which are concerned with development work. I feel it's important that we keep research, development and evaluation as the three phases of carrying an idea through from first thought to a final end product. The Navy is concerned with the evaluation of materials or weapons such as airplanes, engines, guided missiles, etc., to determine whether or not they do the job called for by the specifications."

Col. Donald H. Heaton *(Dir. of Aeronautics & Propulsion, ARDC, USAF):* "Aren't there many ideas that originate in your evaluation work that go back into the research mill?"

Capt. Condra: "Yes, some do go back into research. Normally, we pass such ideas on to the research or development contractor to use at his discretion, and we try to avoid any participation in so-called development work, although we do have our research laboratories. These laboratories, however, devote most of their efforts either to finding better and more expedient methods of testing and evaluating the material we are procuring or to exploring fields of interest in which the Navy is concerned."

Col. Heaton: "I'd like to affirm what Capt. Condra has said, and add that we have another role which is common to both services. That is the role of trying to assess the requirements for future performance that we must have if we are to perform our role. This gives considerable direction and impetus to the work of the applied research people — Dr. Dryden's NACA Committee, for example. We go to Dr. Dryden's group and report the sort of thing we want, the direction we are going, and we ask what he and his committee can do to help us. Similarly, we go to industry because industry does our actual development work.

"The evaluation group comes into this picture at several points, first in the evaluation of proposals by industry and, finally, in the evaluation of the work of industry."

Mr. Littlewood: *"Dr. Millikan mentioned the government research agencies, the various foundations that are devoted to research activities and the many universities that have research staffs. There are also the research activities of various companies. Mr. Raymond, how do we avoid duplication of the work that's going on in these many corridors?"*

A. E. Raymond *(Vice President-Engineering, Douglas Aircraft):* "I might start by outlining the role industry plays in development — the intermediate stage between research and evaluation.

"When industry gets a job to do, it goes over all the research that has been done that might be useful in carrying out the job. If it finds that in certain areas research has not come up with an anwser, industry may then undertake some research on its own. In the aircraft industry the research that is done is primarily in this connection. Some research into basic problems having no direct relation to problems immediately before it, is done, but this is rare.

"Going back to the development of a specific product, industry surveys the research that has been done and then begins development from that point, filling in whatever gaps appear to exist. Following that, industry carries through the design to experimental production and evaluation where it is ascertained whether or not the product meets the specifications established. If the product is deficient, additional development is necessary.

"I'm speaking in a practical sense here, because development of a device actually never stops — it goes on through the life of the product. It is being continually perfected."

Mr. Littlewood: *"Isn't it generally true that, in order to conserve stockholders' funds, the eyes of industry are primarily directed toward the solution of problems which deal with the product under manufacturer or design, rather than the broader base on which the universities or other agencies have undertaken basic research?"*

Mr. Raymond: "That's correct. By and large, the aircraft industry does not undertake research except as an aim to a specific end."

Mr. Littlewood: *"Mr. Lear, have you any comments on that?"*

William P. Lear *(Chairman of Board, Lear Inc.):* "From my experience with research, I'd say it's difficult to detach it from development. As Mr. Raymond brought out, development never stops. It doesn't stop until the article has ceased to be of any use.

"I think pure research must be done by a collective organization that is supported, industry-wide or government-wide, in order to get the basic things that the individual profit-seeking manufacturers can use. If you have to sustain yourself in business, you have to adhere to the principle of working on items that will result in profits for the company. It's difficult to justify engaging in pure research problems, but you can contribute as a company to research and development organizations. I think most manufacturers feel the necessity of contributing to these collective research and development programs in order to obtain fundamentals around which they can develop specific products and hardware.

"As a hardware manufacturer, we find that, although we have a division that is known as a research and development organization, the research is rather a glory attachment to the word, development. Actually we are trying to reduce to practice and develop hardware from information obtained by previous research."

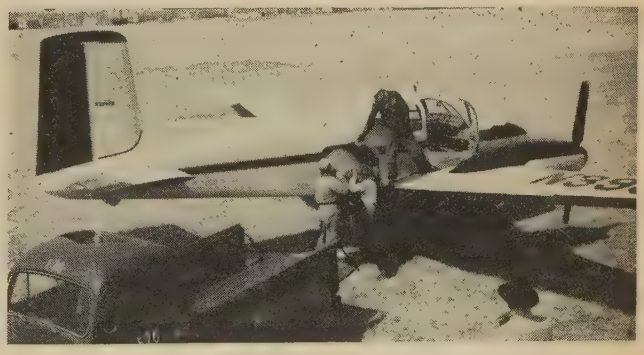
Col. Heaton: "The demands of the military with regard to aircraft performance are insatiable. When we call for the development of a new aircraft and its associated components, our demands are as high as we can make them. Industry, competing for the job of building this equipment, is obligated to extend itself *(Continued on page 52)*

TODAY'S BUSINESS AIRCRAFT

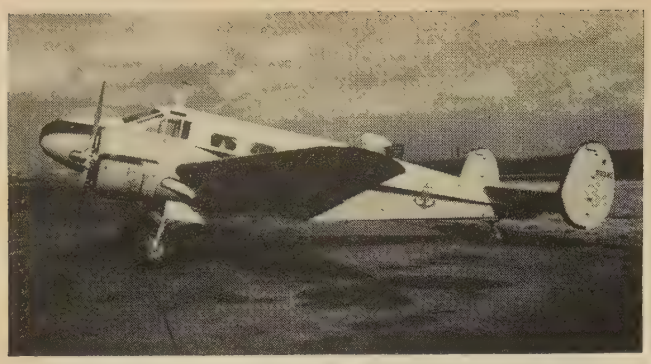
The business aircraft fleet has quadrupled in size in the past six years and today there are more than 10,000 single and multi-engine airplanes in constant use in this mushrooming segment of air operations. Approximately 1800 of them are multi-engine aircraft, including many converted military types dating back to World War II. Business and industry now have an investment of about $200,000,000 in aviation. And the cost of purchasing and modifying new aircraft and keeping the entire fleet in operation exceeds $175,000,000 annually. In 1952, the business aircraft fleet flew approximately 520,000,000 air miles and in doing so were in the air 3,250,000 hours. In the same period, the nation's domestic airlines, using aircraft with higher cruising speeds, flew many more air miles but recorded only 2,625,000 hours. The average annual utilization of business aircraft has climbed above 600 hours. A representative cross-section of business aircraft types is presented in this section.

AERO COMMANDER is a five/six place executive "Twin" powered by geared Lycoming engines. Outstanding feature of the *Commander* is its single-engine performance. The Lycoming engines are rated at 260 hp for take-off, provide a rate of climb of 1700 fpm and a cruising speed of 197 mph. Its range with full fuel load of 145 gallons is 1,150 miles. Gross weight of the *Commander* is 5500 pounds; useful load is 860 pounds. More than 45 Aero *Commanders* have been purchased for business use. Base price of plane is $66,000.

BEECH BONANZA is one of the most popular of the high-performance four-place aircraft in the business fleet. The butterfly-tail *Bonanza* is powered by the dependable Continental E-185 engine; it cruises at 175 mph at 8,000 feet; has a rate of climb of 1,110 fpm and a range of 775 miles. Its empty weight is 1,625 pounds; useful load is 1,075 pounds. Fuel capacity is 39 gallons. The factory price of the *Bonanza,* $19,000, brings it comfortably within the range of many company users not in the market for "Twins."



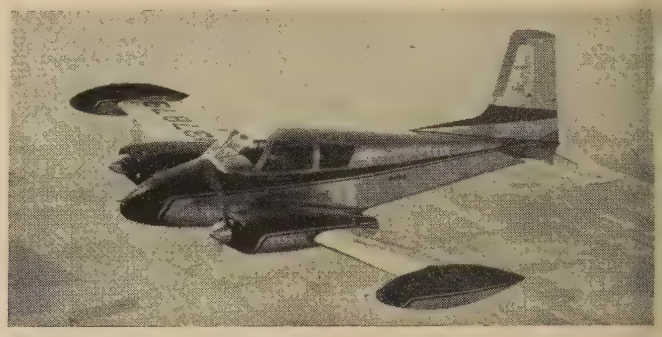
BEECH TWIN-BONANZA is newest member of Beech Aircraft's long line of two-engine aircraft. It is unsurpassed in the excellence of its built-in safety features. This six-place, side-by-side aircraft is powered by two Lycoming GO-435-C2 engines. It cruises at 190 mph at 10,000 feet; has a rate of climb of 1,450 fpm and a range of 1700 miles. With a gross weight of 5500 pounds, its useful load is 1700 pounds. Fuel capacity is 134 gallons. First production was a military version for use in liaison activities.



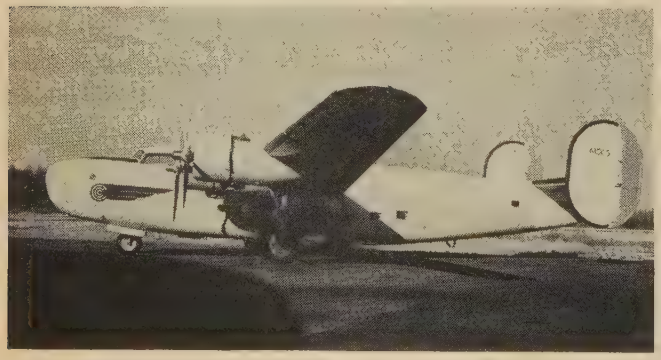
TWIN-BEECH is in greater use as a business plane than any other aircraft. Of the more than 1800 multi-engine company planes, 625 are D18's, either "S" or "C" versions. The D18S is powered by P&W R-985's and the D18C has Continental R9A's. The Continental-powered Twin-Beech cruises at 228 mph at 8500 feet while the P&W-powered D18 cruises at 211 at 10,000 feet. The D18C has a faster rate of climb (1450 fpm as against 1250 fpm) and a longer range (775 to 1180 miles vs. 535 to 910 miles).

CESSNA 180 is a four-place all-metal Businessliner powered by a Continental 0470 engine having a take-off rating of 225 hp. With its full load of passengers, it can carry 120 pounds of luggage and has a range of 675 miles or 4½ hours. The Businessliner has a maximum True Airspeed of 165 mph and cruising TAS of 150 mph. Standard equipment on the 180 includes a stall-warning indicator, cabin radio speaker, etc. Price of the Cessna 180 is $12,950, depending on instruments and radio installed.

CESSNA 195 is a fully instrumented, five-place company aircraft powered by a Jacobs R755 engine having a take-off rating of 300 hp. It has a cruising speed of 165 mph, a 1200-fpm rate of climb and a range of 750 miles. The 195 has a gross weight of 3,350 pounds and an empty weight of 2,030 pounds. Price of the 195 (also dependent upon instrumentation, radio, etc.) is $22,000. The Cessna 195 is in extensive operation as a company plane by several oil companies, chemical manufacturers, construction companies.



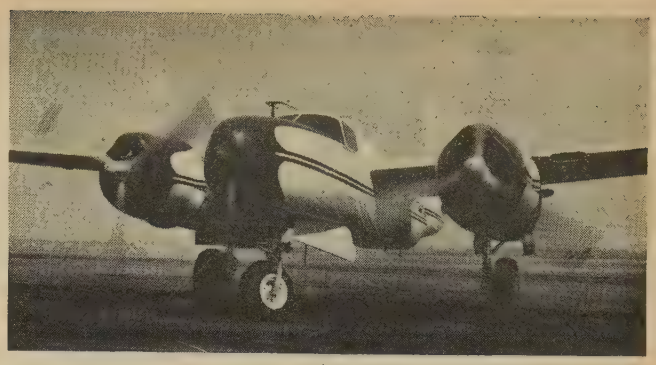
CESSNA 310 is one of the newest "Twins" to be designed for the business-plane market. It seats five and is powered by Continental 0470 engines. No performance figures are as yet available, but according to reports it has exceeded the performance expected by its designers. Feature of the new Twin-Cessna is its wingtip fuel tanks; another is its internal radio antenna. The wingtip tank arrangement is one that has been requested by many business-plane pilots. Cessna expects the 310 to be coming off production lines by Spring.



CONSOLIDATED B-24 is being used largely as a sleeper plane by those companies requiring executive travel coast-to-coast on a non-stop basis. Powered by P&W 1830-43 engines, the B-24 cruises 225 mph at 10,000 feet on 60% power and has a range of 3600 miles. The B-24 being operated by one company was modified to provide six berths and two reclining chairs; another company's seats 14. Price of the B-24 varies from $50,000 to $250,000, depending upon conversion, interior appointments, instrument and radio installation, etc.

CONVAIR 340, while not yet in quantity use as a company airplane, is considered one of the best, performance-wise, and is a looked-forward-to business aircraft by many a chief pilot and aviation department executive. There are two 240's and two 340's in business use today. The 340 is powered by P&W R2800-CB-16 engines, cruises at 284 mph at 18,000 feet on 60% of power and has a range of 2,015 miles. It has gross weight of 47,000 pounds; empty weight of 29,486 pounds. Price given for 340 is $600,000 to $750,000.

DEHAVILLAND DOVE has become an exceedingly popular business airplane and is one of the first foreign-built air planes to have successfully competed with U.S. aircraft on the business market. There are more than 35 *Doves* presently in operation as company planes. Powered by two *Gypsy Queen* 70 engines, the *Dove* cruises at 179 mph at 8,000 feet; has 750-fpm rate of climb and a 500-mile range. Various business conversions give it a seating capacity of from five to eight. Market price of the *Dove* is $89,000.

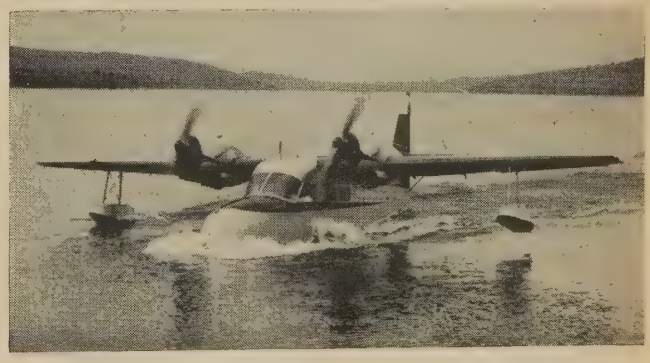


DOUGLAS A-26, now designated B-26, is a five-place airplane that offers its business operators speed and range. Powered by P&W R-2800 engines, the business A-26 has a maximum TAS of 400 mph and a cruising TAS of 340 mph at 17,500 feet. It has a range of 3400 miles and a fuel capacity of 1600 gallons. Its gross weight is 26,500 pounds. There are some 25 A-26's in use today as company airplanes. The cost of an A-26 modified for business and executive use is reported to be in the vicinity of $500,000.

DOUGLAS B-23, converted to company use, provides comfortable seating for eight to 11 passengers. Powered by two Wright R-2600 engines, the modified B-23 has a maximum TAS of 292 mph and cruises at 240 mph. Equipped with long-range fuel tanks (1200 gallons), the B-23 has a range of 2,000 miles. Conversion of the B-23 shown here was done by AiResearch and it averages 60 flying hours per month. There are 15 of these planes in business use at the present time. Price of a converted B-23 is given as about $200,000.

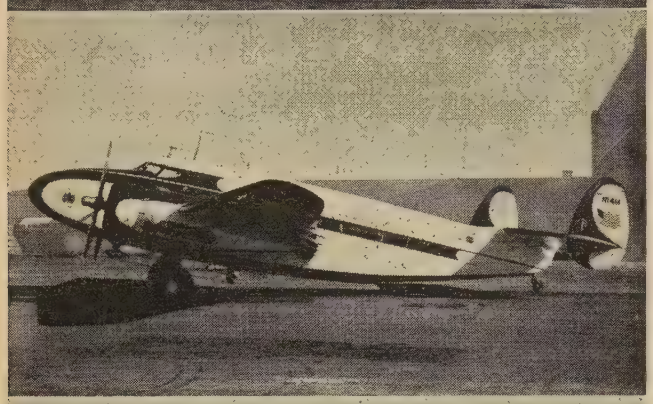
DOUGLAS DC-3 shares quantity honors with the Twin Beech in the business fleet. There are 270 DC-3's in business use today, each one a luxuriously appointed company plane seating between 14 and 18 passengers. Powerplants of the DC-3 are either P&W R-1830-75 or -94; P&W R-1830-92; or Wright R-1820-6202A. Price of the business DC-3 varies from $100.000 to $198,000; and the operating cost of a DC-3 (typical 600-hour per year utilization) runs between $50,000 and $75,000. The DC-3 is noted for safety, dependability.

DOUGLAS SUPER DC-3 is being used by one of the nation's steel companies. An improved version of the DC-3, it is powered by Wright R-1820-C9HE engines having a take-off rating of 1475 hp each. It has a maximum True Airspeed of 270 mph and cruises at 251 mph at 15,400 feet. Its rate of climb is given as 1,300 fpm and range as 1,425 miles. The Super DC-3 has a gross weight of 31,000 pounds and an empty weight of 19,537 pounds. The Super DC-3's presently in company use are airline versions seating 20 to 30.

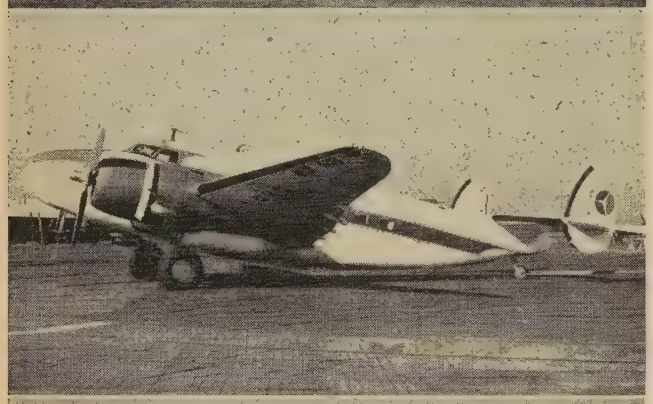


GRUMMAN WIDGEON is a four or five-place amphibian. The latest version features installation of two Lycoming engines instead of the Ranger 6-440C-5's. Engineering and modification costs of this version up the price of a *Widgeon* from the standard $15,000-$25,000 to about $65,000. The Lycoming-powered *Widgeon* cruises at 160 (Ranger-powered: 130 mph). The Ranger-*Widgeon* has a 1,000-fpm rate of climb, a range of 715 miles; gross weight of 4,525 pounds and empty weight of 3,240. There are 140 in use.

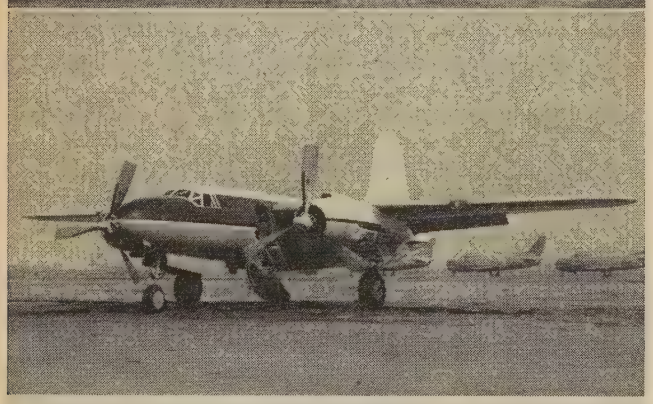
GRUMMAN MALLARD is a six-to-10-place amphibian, 53 of which are in daily use as business aircraft. Powered by P&W R-1340 S3H-1 engines of 600 hp, the *Mallard* has a maximum True Airspeed of 215 mph and a cruising speed of 180 mph at 8,000 feet. It has a rate of climb of 1,290 fpm and a range of some 730 miles with full load. It has a fuel capacity of 380 gallons, a gross weight of 12,750 pounds and an empty weight of 9,350 pounds. Price of a *Mallard* is $140,000. Among users are Superior Oil, Burlington Mills, Fuller Brush, Briggs Mfg., etc.



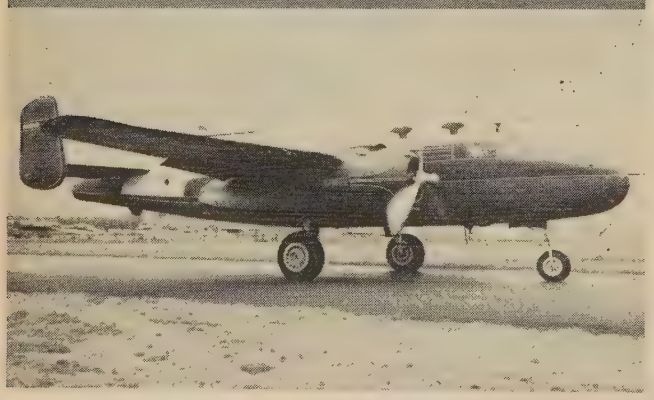
LOCKHEED LODESTAR is an "old favorite" in the business aircraft field. Powered by P&W R 1820-87 engines, it has cruising speed of 215 mph at 10,000 feet. Various conversions seat from eight to 11 passengers, and some are powered by R-1830-94 engines which raise the cruising speed to over 225 mph. A new version of the *Lodestar* recently was announced by Lear Aircraft Service. Their modification, called "Learstar," offers greatly improved performance. The Lear modification program takes about 4 months. Already several *Lodestars* are in the Lear shop for this.



LOCKHEED PV-1, which is becoming increasingly popular as a business aircraft, is powered by two P&W R-2800-31 engines of 2,000 hp each. The PV-1 has a top speed in excess of 300 mph and cruising speed of 275 mph. It has a range of more than 2,000 miles, a fuel capacity of 1,070 gallons and a gross weight of 31,000 pounds. Price of a converted *Ventura* is given at upwards of $150,000. According to a recent survey, there are 15 Lockheed PV-1 *Venturas* in operation as business aircraft. Among users are Parker Pen, Dresser Industries, Fruehauf, etc.

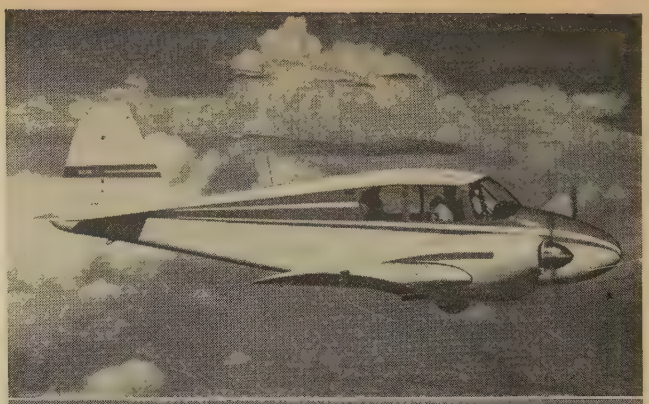


MARTIN B-26 a business conversion of the World War II Martin *Marauder,* is powered by P&W R-2800-CB-16's and carries from 14 to 16 passengers. In use by four companies, the B-26 converted costs between $150,000 and $350,000, depending upon appointments, equipment, etc. It has a maximum TAS of 350 mph, a cruising speed of 285 mph at 10,000 feet, a 1500-fpm rate of climb, and a range of 2200 miles. It has a gross weight of 35,000 pounds, an empty weight of 24,000 pounds. Most conversions include the air-step door as shown in the photo here.



NORTH AMERICAN B-25 executive transport (J version pictured here) is powered by two Wright R-2600-29 engines having a take-off rating of 1900 hp each. The B-25 seats eight comfortably, cruises at 265 mph and has a range of 2100 miles. It has a useful load of 13,433 pounds and a take-off weight of 34,000 pounds. Several B-25's have a cargo compartment in the nose, adequate for 1,000 pounds of baggage. The current market price of a B-25 converted for business use is said to be $140,000. There are 25 B-25's in the present business fleet.

PIPER APACHE is a small "Twin" specifically designed for company operations that want two-engine safety but who are not interested in the heavier "Twins." The *Apache* is powered by two Lycoming 0-320 engines having a take-off rating of 150 hp each. It has been reported that the *Apache* will cruise at 175 mph at 9,000 feet and will operate into and out of the same small fields that take the *Cubs*. It has a fuel capacity of 72 gallons, a gross weight of 3500 pounds and an empty weight of 2,160 pounds. No other details are available now.

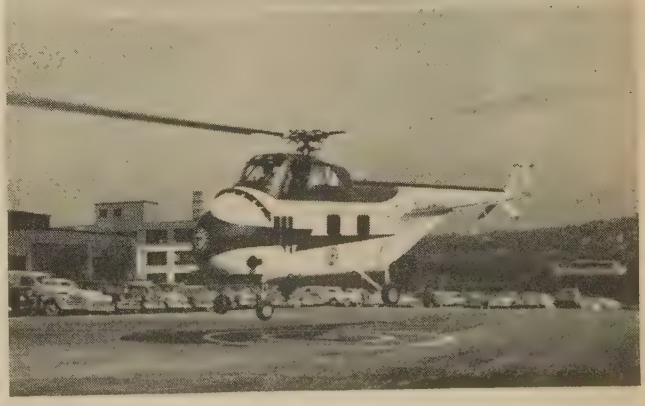


RYAN NAVION shares the single-engine business-plane popularity with the Beech *Bonanza*. The *Navion* is powered by either a Lycoming GO-435 or a Continental E-185. The Lycoming-powered *Navion* cruises at 170 and has range of 595 miles; the Continental-powered *Navion* cruises at 155, has range of 500 miles. The Continental *Navion* (built 1947-'49) is available at $5500 to $9,000; the Lycoming *Navion* is currently priced at $12,000 to $14,000. Instrumentation, equipment is the difference between the $6,500 and $9,000 price, and the $12,000 to $14,000.

RILEY TWIN-NAVION is a conversion of the standard four-place *Navion*. The conversion is fitted with Lycoming 0-290D-2A engines of 140-hp each, and a cleaned-up cowling has been used. It is also available with Lycoming 0-320 150-hp engines. Its props are full-feathering constant speed Hartzells (also used on new Piper *Apache*) and the instrument panel features individual Grimes lights. The *Twin-Navion* cruises at 160 mph and has range of 720 miles The *Twin-Navion* sells for $24,850 above original airframe, but new engines, interior, props are supplied.

BELL helicopters are becoming increasingly important in the business-plane field. Thus far, most the helicopters are employed in pipeline patrol work by oil and gas companies, in geological and geophysical survey work, and in cargo and personnel delivery work in mountainous hard-to-get-to areas of this country and Canada. Some are being used in shuttle service from airports to hotels in outlying areas. The two/three-place Bell helicopter is performing a useful service in many businesses, a service that no other type vehicle can do as well.

SIKORSKY S-55 has come into prominence as a personnel transport in those cases where short-haul service is required. The Rockwell Manufacturing Company, whose S-55 is shown here, uses their 'copter between plants located in cities from 40 to 207 miles from the main plant at Pittsburgh. The S-55 can carry as many as eight passengers plus a crew of two for a distance of 100 miles. It has a cruising speed of 90 mph. Like the Bell, the Hiller, etc., the S-55 offers a time-saving factor beyond that of conventional aircraft traveling airport to airport.



Business Aircraft Specifications

Aircraft	Seats	Engine	TO/hp	Max. TAS	Cruise TAS	Rate of Climb	Range	Fuel Capacity	Gross Wt.	Empty Wt.	Price Range
Aero Commander	5-6	2 Lycoming GO-435C2	260	211 mph	197 mph	1700 fpm	1150	145	5,500 lbs	3,640 lbs	$ 66,000 (Standard model)
Beech Bonanza	4	Continental E-185	205	190	175	1110	775	39	2,700	1,625	19,000
Twin-Bonanza	6	2 Lycoming GO-435C2	260	202	190	1450	975	134	5,500	3,800	.....
D18C	5-7	2 Continental R9A	525	240	228	1450	775-1180	206	9,000	5,900	73,000
D18S	"	2 P&W R-985	450	230	211	1250	535-910	"	8,750	5,615	"
Cessna 180	4	Continental O-470	225	165	150	1150	675	60	2,550	1,460	12,950
195	5	Jacobs R755	300	180	165	1200	750	80	3,350	2,030	22,000
Twin-Cessna	5	2 Continental O-470	225	...	...	1220	....	100	....	....	.....
Consolidated Vultee B-24	14	4 P&W 1830-43	1200	280	225	1500	3600	3200	58,000	33,000	$ 50,000 to $250,000**
340	24-32	2 P&W R-2800-CB16	2400 wet	314	284	1220	2015	1750	47,000	29,486	$600,000 to $750,000**
DeHavilland Dove	5-8	2 Gypsy Queen 70	340	210	179	750	500	202	8,500	5,625	$ 89,000
Douglas A-26*	5	2 P&W R-2800	2000	400	340	....	3400	1600	26,500	.....	$500,000
B-23	11	2 Wright R-2600	1750	292	240	....	2,000 with long-range tks	....	30,475	.....	$200,000
DC-3**	14-18	2 P&W R-1830-75;-94	1350	225	204	1130	1510	800	25,200	16,000	$100,000
	"	2 P&W R-1830-92	1200	...	210	....	1510	800	25,200	to	to
	"	2 Wright R-1820-G202	1200	...	180	....	1510	800	"	19,000	$198,000
Super DC-3	20-30	2 Wright R-1820-C9HE	1475	270	251	1300	1425	...	31,000	19,537	.....
Grumman Widgeon	4-5	2 Ranger 6-440C5	200	160	130	1000	715	108	4,525	3,240	$ 15,000 to $25,000
	"	2 Lycoming GO-435	260	182	160	1750	600	...	5,000		$ 65,000
Mallard	6-10	2 P&W R-1340-S3H-1	600	215	180	1290	730	380	12,750	9,350	$140,000
Lockheed Lodestar	11	2 P&W 1820-87	1200	266	215	...	1660	644	18,500	12,075	$ 80,000 to $135,000**
PV-1	8-12	P&W R-2800-31	2000	300 +	275	....	2000 +	1070	31,000		$150,000
Martin B-26	14-16	2 P&W R-2800-CB16	2400 wet 2050 dry	350	285	1500	2200	1550	35,000	24,000	$150,000 to $350,000**
North American B-25***	8	2 Wright R-2600-29	1900	...	265	2100	2100	1009	34,000	20,567	$140,000
Piper Apache	4	2 Lycoming O-320	150		175	....	....	72	3,500	2,160	
Ryan Navion	4	Continental E-185	205	163	155	900	500	40	2,750	1,680	$ 6,500 to $9,000
	"	Lycoming GO-435	260	174	170	1250	595	"	2,850	1,930	$ 12,000 to $14,000
Riley Twin-Navion	4	2 Lycoming O-320D	150	170	160	1400	720	60	2,950	2,100	$24,850 plus cost of original airframe

*Pressurized version by AiResearch. **Price dependent in all cases upon conversion, interior appointments, equipment, etc.
***Specifications are J version. Note: All prices quoted are current market and subject to change. Source: AiResearch, Remmert-Werner; Wm. C. Wold; and Powers and George.

NOW

BENDIX-PACIFIC HYDRAULIC AND ELECTRO-MECHANICAL ACCESSORIES

Available Through Distributors

NEW CONVENIENCE FOR AIRLINES, CORPORATION AIRPLANE OPERATORS AND PRIVATE OWNERS

Bendix-Pacific Hydraulic and Electro-Mechanical products—which have been specified for years as original equipment on most American airplanes—are available through local distributors.

Now, more than ever, insist on Bendix-Pacific quality products for all replacements or modification work. Please contact your nearest source shown below.

These famous Bendix-Pacific Products are available to you locally

- **Hydraulic Accumulators Spherical and Cylindrical**
- **Hydraulic Flow Equalizers and Proportioners**
- **Hydraulic 4-Way Valves Manual, Solenoid, motor driven, pilot operated**
- **Hydraulic Hand Pumps**
- **Hydraulic Pressure Reducers**
- **Hydraulic Unloader Valves**
- ***Geneva-Loc* Electrical Actuators**
- **Position Light Flashers**
- **De-icer Timer**

THESE DISTRIBUTORS ARE NOW READY TO SERVE YOU

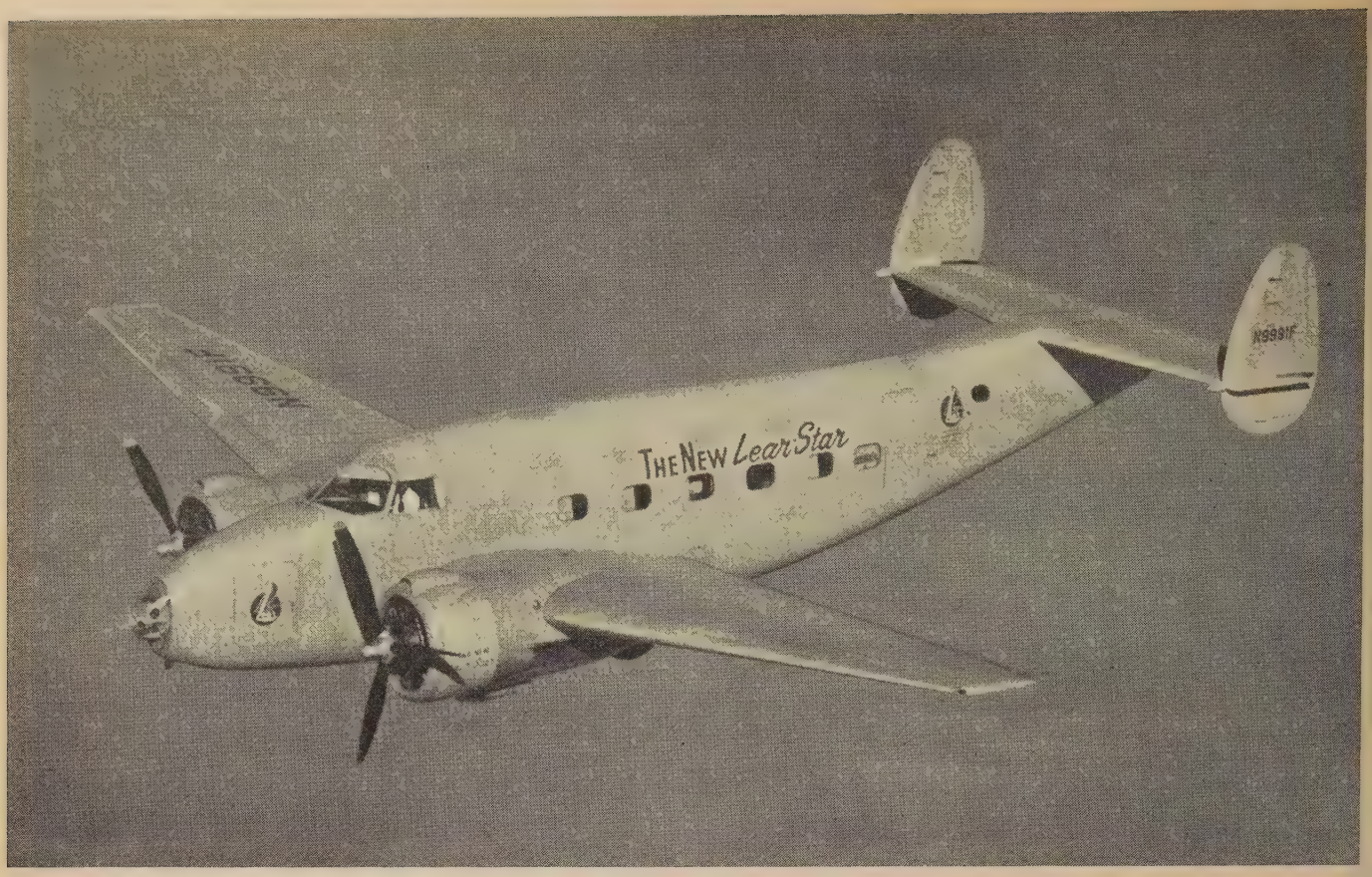
Southwest Airmotive Co.
Love Field
Dallas 9, Texas

Airwork Corporation
P.O. Box 194
International Airport
Miami 48, Florida

Standard Aircraft Equipment Co., Inc.
241 Old Country Road
Mineola, New York

Aviation Electric, Ltd.
3483-5 Park Avenue
Montreal 18, P.Q. Canada

Bendix
Pacific Division
Bendix Aviation Corporation



First flight photograph of the Lear-Star during a glide test with power off and both propellers feathered.

GLIDE TESTING THE LEAR-STAR

How flight test techniques developed in studies with personal aircraft and a sailplane are contributing to improved performance of the new Lear-Star

The precise glide-test flight research techniques which produced the proficient, record-breaking RJ-5 sailplane are being used by Lear, Inc., to improve performance of the Lear-Star, executive modification of the Lockheed *Lodestar*.

Dr. August Raspet, head of the Aerophysics Department of Mississippi State College, is supervising the flight program in cooperation with Lear's chief engineer, Gordon Israel, and its research pilot, Ed Swearingen. The objective of the Lear modification is a high-performance *Lodestar* with cruising speed of 300 mph.

Basically, the Lear-Star glide-test program is a series of long glides—from 20,000 to 10,000 feet—with both propellers feathered. The drift-down glides are then followed by drag measurements with power on. A comparison of the power required in the glide and that under power is expected to provide an accurate indication of the propulsive efficiency of the airplane.

The results of the tests will help to determine how the Lear-Star will be modified to gain additional speed with the most economical fuel consumption. The series of flights completed by Swearingen to date has ranged from the stall up to top speed, enabling Dr. Raspet and his staff to compute drag efficiency over the complete range of flight.

Another phase of the Raspet-Lear tests will cover the use of torque meters to measure brake horsepower. From the thrust horsepower in the glides and the brake horsepower, the over-all propulsive efficiency and the true drag co-efficient will be determined.

These results will be analyzed in terms of what can be expected from boundary layer control. Corrections will be applied in regions where separated air flow exists, as shown by tuft photos, or the laminar flow will be extended.

Israel already has designed a new engine nacelle to assist in drag reduction. This modification preceded the glide-test flights, because it was obvious that the wheel, even though retracted, would be a penalty in drag.

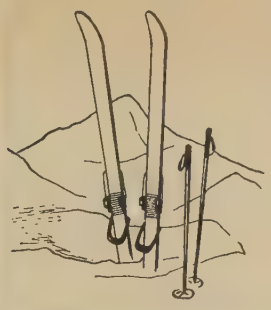
The progression from flight test to analysis to modification to flight test to modification will yield the drag increment of change and provide a yardstick against which the gains in performance can be evaluated in terms of costs.

Back of the Raspet-Lear program with the Lear-Star is the realization that airplane performance measurement is a highly standardized procedure to prove predicted performance and to guarantee that figure.

However, according to Dr. Raspet, measuring horsepower required with a torque or thrust meter at various speeds yields only a curve of the power needed. He believes that such a power curve does not permit a reliable measurement of aerodynamic drag. True aerodynamic drag cannot be separated from propeller efficiency, cooling losses and slip-stream effects. In short, he says, the classical power curve fails to yield all information needed to diagnose the ills of an airplane.

Realizing these shortcomings, the Aerophysics Department of Mississippi State College began several years ago an analysis of several personal aircraft. Each airplane was towed to 10,000 feet with propeller removed and then released. Measurements were made of sinking speeds throughout the speed range of the airplane. Results showed thrust horsepower required with engine cowls open and sealed. Brake horsepower was determined in powered flights. The propulsive efficiency of each airplane was the ratio of thrust to brake horsepower.

PLANE FAX



Your Best Week-end Flight Plan for November

Fly to Alta, Utah, for the "first snow" skiing in this famous resort area. Plan to land at Salt Lake Municipal Airport #1 or at Utah Central Airport near Salt Lake City for quality Standard Oil aviation products.

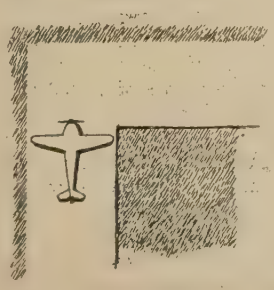
Wolf hunting by air above the Arctic Circle

Glacier-hopping wolf hunts are just part of the day's work for Frank Whaley, who is the Kotzebue, Alaska, pilot and station master for the Wien Alaska Airlines. In 50-below-zero weather, he flies over icy mountain ranges in search of reindeer-killing wolf packs, then throttles down to fly at 60 feet above the snow, within shotgun range of the killers.

"Low flying at slow speed is never easy," says Mr. Whaley, "and when it's done at temperatures way below zero while headed toward a canyon wall, I want to be sure that I have plenty of extra power available. We've found that Chevron Aviation Gasoline 80/87 gives us more power on take-offs and a greater reserve of power in flight than any other fuel we've tried. Chevron 80/87 always gives us superior performance, even in bitter cold, and never fouls our spark plugs.

"And because we pre-heat oil almost to the boiling point before starting any engine, the oil we use must be of exceptional quality. New RPM Aviation Oil withstands this rugged treatment, where other oils break down. What's more, New "RPM" keeps our engines running smoothly for long periods, even under our extreme operating conditions."

T. M.'S "RPM", "CHEVRON," REG. U.S. PAT. OFF.



TIP OF THE MONTH

During the run-up before take-off, it's always a good idea to make sure the carburetor heat mechanism is operating properly, especially in cold weather or before high-altitude flights.

CHEVRON AVIATION GASOLINE

NEW RPM AVIATION OIL

STANDARD OIL COMPANY OF CALIFORNIA

Official NBAA Report

NATIONAL BUSINESS AIRCRAFT ASSOCIATION, INC.

(formerly Corporation Aircraft Owners Association)

National Business Aircraft Association, Inc. is a non-profit organization designed to promote the aviation interests of the members firms, to protect those interests from discriminating legislation by Federal, State or Municipal agencies, to enable business aircraft owners to be represented as a united front in all matters where organized action is necessary to bring about improvements in aircraft equipment and service, and to further the cause of safety and economy of operation. NBAA National Headquarters are located at 1029 Vermont Ave., N. W. Washington 5, D.C. Phone: National 8-0804.

NBAA Plan for Mobilization Adopted as Interim Measure

Recognizing the vital role that civil air transportation will play should major industrial, military and population centers of the United States be subjected to air attack, the National Business Aircraft Association has designed a special interim plan to utilize, on a voluntary basis, every multi-engine business airplane of its members to help meet the emergency defense airlift needs of the nation. These include the DC-3, the *Lodestar*, Convair and other types having a gross weight of 12,500 pounds or more, and such four-engine aircraft as are not assigned to the airline CRAF Plan (Civil Reserve Air Fleet).

NBAA Mobilization Plan

If there is a widespread attack upon the U. S., all aircraft will be grounded under the SCAT plan (Security Control of Air Traffic), and aircraft in flight probably will be required to land at the nearest airport. According to the NBAA plan, NBAA flight crews will notify the nearest airline operations office of their identity, type of aircraft, and state of readiness to carry out emergency transport missions for the Armed Forces and Civil Defense agencies. Owners and flight crews of NBAA aircraft not in flight at the time will telephone the same information to the nearest airline operations office.

Meanwhile, the Federal Civil Defense Administration office will call the nearest Regional Air Priorities Control Office (RAPCO) and report FCDA's requirements for immediate air transportation of passengers and cargo between points of origin and points of destination.

The Regional Air Priorities Control Offices are set up on an interim basis at the same cities where they were located during World War II, (Atlanta, Boston, Buffalo, Chicago, Cleveland, Dallas, Dayton, Denver, Detroit, Kansas City, Los Angeles, Memphis, Minneapolis, Miami, New Orleans, New York, Pittsburgh, San Francisco, Seattle, Washington) and are at the airlines' communications centers. The RAPCO's will transmit FCDA's emergency airlift requirements through the airlines' and other communications networks to every airline station in the area.

The local airline operations offices will dispatch airline aircraft as needed, but they will not dispatch NBAA multi-engine aircraft. The airline office will merely transmit information regarding FCDA's requirements to the NBAA Aircraft Mobilization Coordinator who, in turn, will confer with the Director of Priorities and the RAPCO personnel stationed at major airline communications stations.

It will be the NBAA Aircraft Mobilization Coordinator's job to direct the orderly and expeditious dispatch of NBAA aircraft within their respective regions, to help meet FCDA's needs. NBAA will additionally designate, insofar as possible, an NBAA Operations Coordinator to assist in the dispatch of NBAA member aircraft that have checked in at each of the main airline or "control" airports.

When NBAA member aircraft operators receive the information from airlines communications, they will proceed in accordance with previous arrangements made with FCDA, and from then on will operate independently of the airline communications system, except that NBAA aircraft will receive information regarding additional requirements as they develop.

NBAA aircraft will load essential passengers and material as assigned by FCDA, will file their flight plans directly through the normal channel of CAA Air Traffic Control, and upon arrival at the destination point, will again check in with either the NBAA Aircraft Mobilization Coordinator or NBAA Operations Coordinator for any further information regarding urgent needs.

Preparation of the NBAA Plan

The NBAA Mobilization Plan was prepared under the direction of the Board of Directors of NBAA. It was vigorously impressed upon Federal officials that NBAA business-aircraft owners and operators must be permitted maximum use of their aircraft, flight crews and facilities in the performance of airlift missions. The fact was also brought out that any unauthorized military seizure of NBAA multi-engine aircraft primarily equipped for business transportation so that conversion be made for cargo use would prove wasteful of the capabilities of the aircraft to perform the vital transport of officials of private industry on defense matters, for military liaison and for civil defense needs.

Numerous NBAA business-aircraft owners and operators are currently engaged in the defense production program, and the indiscriminate or unauthorized use of their aircraft and flight personnel would prove detrimental to the emergency effort as well as to the industrial and business pursuits of those organizations.

Equipment

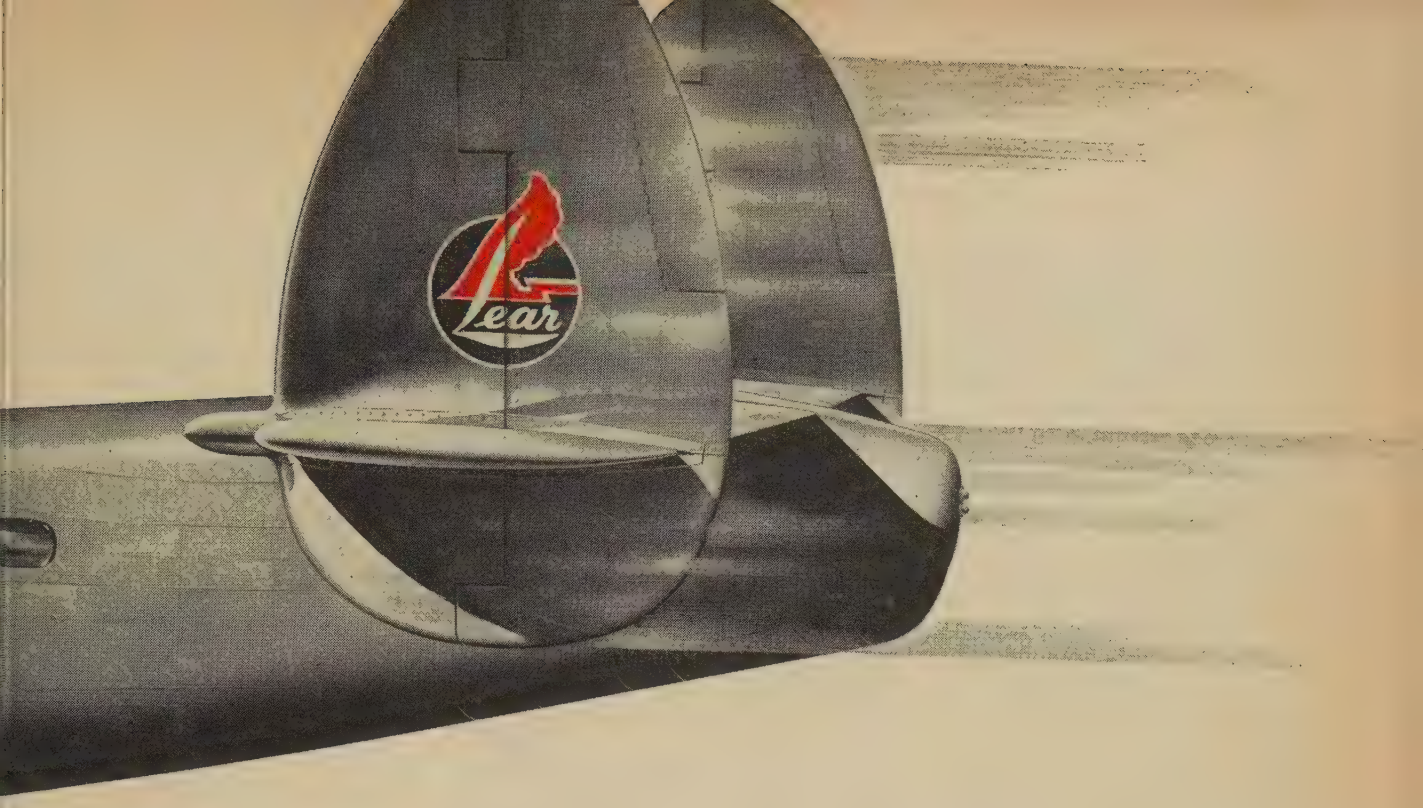
Visualizing use of the NBAA business fleet of transport-type aircraft, the plan had to take cognizance of the fact that those aircraft are equipped as well as or better than the scheduled airline aircraft as far as instrumentation, communications equipment and safety devices are concerned. Most of the pilots have had thousands of hours of flight experience and have either a military or an airline background, or both. Many NBAA pilots also are engaged in international business operations.

Action Required

After agreement on principles of the mobilization plan between NBAA, FCDA and DATA as well as representatives of the scheduled and non-scheduled air carriers, the interim plan requires formal clearance with other government agencies through the Office of Defense Mobilization (ODM). In addition, the following action is required:

1. FCDA must secure the release of NBAA member multi-engine aircraft from jurisdiction of State civil defense organizations.
2. FCDA must secure agreement from Hq. and local military authorities to insure that in event of martial law arbitrary jurisdiction over NBAA multi-engine aircraft would be unauthorized.
3. FCDA must outline in clear and simple manner exactly what procedures would be followed by NBAA owners and operators of these multi-engine aircraft which will carry civil defense traffic as needed.
4. FCDA must arrange stand-by contracts with the NBAA members covering operation and maintenance costs, flight crew salaries and insurance.
5. DATA, through the Air Priorities Board, has to notify air carriers of these plans, authorize appropriate legal powers, and arrange for participation of non-certificated carriers and others who can contribute to the system. DATA also must provide aircraft identification insignia and credentials for NBAA flight crews.
6. FCDA must notify all civil defense organizations of the plan and procedures so that lines of authority will be clearly defined.

NBAA believes that organizations owning and operating multi-engine aircraft, not presently members of the Association, would be interested in cooperating in this simplified interim operational plan to voluntarily mobilize the business aircraft fleet in the interests of national defense.



"It's the New Learcraft ~~Speed~~ Conversion!"

Over 270 mph cruise. Increased range. Shorter take-off. Faster climb. Improved single-engine performance. Stronger structure. Lower cabin noise and vibration level. Larger cockpit. Better visibility. Improved control pedestal design and arrangement. Easier and lower cost maintenance. Lower operating costs. Superfine cabin design and furnishings.

These are a few of the many good things you get with a Learcraft conversion package.

How can so much be done for a Lodestar? By applying thousands of engineering man-hours, thousands of shop-hours, hundreds upon hundreds of wind tunnel and flight-test hours, and 20 years' first-hand study of executive aircraft requirements.

Orders are being accepted now for 1954 delivery of a complete Learcraft package, including basic airframe, or for the Learcraft modifications applied to your own Lodestar. Direct inquiries on your company letterhead to:

LEARCRAFT CONVERSIONS, INC.
SANTA MONICA AIRPORT, SANTA MONICA, CALIFORNIA

SKYWAYS FOR BUSINESS

NEWS NOTES FOR PILOTS, PLANE OWNERS OPERATING AIRCRAFT IN THE INTEREST OF BUSINESS

SOCONY-VACUUM *Oil Company has added Cessna 180 to its fleet of aircraft. This one, based at Wichita, is flown by Dwayne Harsh (above) who became a Socony pilot in 1941*

Lear-Modified Lodestar Offers 300-mph Cruising

Los Angeles, Cal. Those companies in the market for a high-speed executive airplane and whose pilots bear traces of sentiment for ye olde *Lodestar* will be heartened by news of the successful modification of Lear, Inc.'s *Lodestar*, now known as the *Learstar*, and its cruising speed of 300 mph. The "new" *Learstar* recently made two cruising runs over Santa Monica Bay and Catalina Island, attaining a cruising TAS of 300 mph at 18,000 feet, using 57½% of rated METO engine power.

In announcing the speed of his most recent project, William P. Lear, Director of Research and Development for Lear, Inc., pointed out that the *Learstar* has been undergoing extensive modification during the past 18 months, and incorporates many new features designed by Lear engineers and fabricated and installed by Lear Aircraft Service Division at its Santa Monica hangar facility. Modifications include new streamlined cowlings, new augmenter-type exhaust system, removal of "bat-wings" and external flap tracks, closing of the wing slots, squared wing and stabilizer tips, increased stabilizer angle of incidence, new windshield, flush windows, flush air intakes and exhausts, smaller main wheels and a fully retractable tail wheel. Other modifications to be made and which will further increase the aircraft's speed include main landing gear wheel-well doors, wingtip tanks, new wing leading edge and further streamlining of the windshield, cowlings and other airframe components. A probability is a cabin pressurization system to allow continuous high-altitude cruising. This is under development now by the Lear engineering staff.

According to Mr. Lear, Lear Aircraft Service expects to sell a *Learstar* modification program. At the present time, production facilities and organization of a sales and service program are being expedited by the company at Santa Monica.

Executive Air Transport Co. Schedules Second Seminar

New York, N. Y. Following the success of its first seminar for business pilots, the Executive Air Transport Co., Inc. has scheduled a second one for October 30, 31 and November 1 at The Pickwick Arms Hotel, Greenwich, Conn. The agenda of this meeting will include lectures on approach systems; instrument flying, with emphasis on flying techniques under varying weather conditions; weather forecasting; air traffic control; and progressive maintenance.

Speakers at the sessions will be Capt. Vernon A. Peterson of Eastern Air Lines, William Fish of Pan American World Airways, W. B. Beckwith, Assistant Chief Meteorologist, United Air Lines, Mike Lepanto, Flight Engineer, UAL, John Moriarity of the CAA, and Capt. Harry R. Van Liew, United Air Lines.

Pilots wishing to attend this session should communicate with Executive Air Transport Co., Smithtown Branch, L. I., New York.

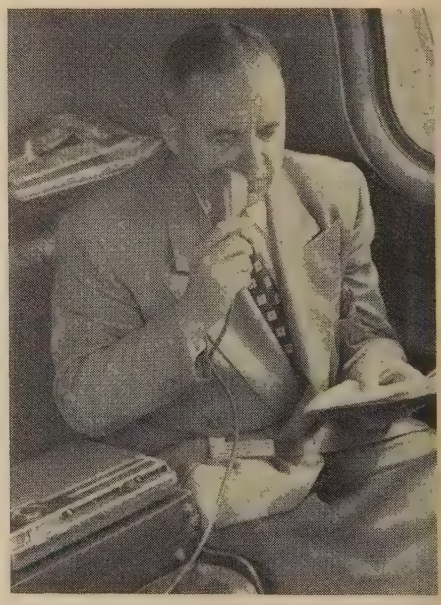
Socony-Vacuum Adds Cessna 180 to its Aircraft Fleet

Wichita, Kan. Socony-Vacuum Oil Company, Inc. recently added a Cessna 180 to its stable of aircraft employed by the company's Pipeline Department, Wichita. The new airplane will be based in Wichita, and when not on actual pipeline patrol duty, it will be used as a personnel transport. Pilot of the new Cessna 180 is Dwayne Harsh who joined Socony in 1941. The airplane will be hangared with the Yingling Aircraft Company.

P&W Engines Replacing R-1830's on Two DC-3's

New York, N. Y. Two executive-type DC-3 aircraft, one owned by Arthur Godfrey Enterprises and the other by Olin Industries, are being converted to Pratt & Whitney R-2000 Twin Wasp. This change in powerplants will increase the DC-3's cruising speed to about 190 mph TAS and will raise the effective ceiling substantially.

The modification job on these aircraft probably will also include the addition of a rudder boost system to compensate for the R-2000's extra one-side power during single-engine operation. A development of the R-1830 series of P&W engines, the R-2000 has a take-off rating of 1450 hp at



"BUSINESS AS USUAL" *could be the title of this in-flight photo of R. J. Cowden, who is Sales Manager of Lycoming-Spencer Div. of Avco, in his company's Twin-Bonanza*

2700 rpm and a normal rating of 1200 hp at 2550 rpm. The R-1830 which now powers the two DC-3's is rated at 1200 hp at 2700 rpm and provides 1,050 hp at 2550 rpm for cruise.

New Wingwax Product Offers Protection to Plane Surfaces

Dayton, Ohio. Speeding up airplanes by as much as 12 mph and protecting the finish of helicopter rotor blades has been the experience of several pilots and aircraft owners who have used a specially formulated wax brought out by the Wingwax Company in Dayton.

This special wax is composed of a high melting point wax in solution, and it is applied by a vacuum-type spray gun using 45 to 50 lbs pressure. On evaporation of the solvent, the wax completely adheres to the painted, the lacquered or alclad surface.

It has proved of considerable help in preventing damage to tail rotor blades on helicopters used in agricultural work. The areas waxed have proved to be almost immune to the stripping action of the 2-4-D insecticide. The wax also aids in eliminating moisture absorption of the main rotors. One 'copter operator in a mountainous area reported that frost forming overnight on his copters considerably shortened his work schedule because he had to hold up operation of the helicopters until the frost had melted. He found that after applying this special wax, the frost remained dry and could be easily brushed off.

The wax is resistant to normal gasoline and oil spillage; is transparent and will not chip or peel. Due to its hardness, only a minimum of dust will adhere to its surface. One gallon of the wax will cover from 3500 to 4,000 square feet; and one person can cover a C-47 in less than an hour.

DELOS RENTZEL, *former Chairman of CAB and now President of Auto Transports, Inc., recently was elected to Board of Directors of National Business Aircraft Association*

....in the Business Hangar

Harvey Glass, Chief Pilot for Texas-Illinois Pipeline Company and also his company's NBAA representative, brought the company DC-3 to Northwestern Aeronautical at Holman Field for 100-hour check and installation of a bird-proof windshield.

Studebaker Corporation's DC-3 recently stopped at Southwest Airmotive for service. Aboard was Mr. H. S. Vance, president of Studebaker. Captain of the company DC-3 is Roy D. Black, Don Westfall is first officer and Ed Fenton, mechanic.

Federal Petroleum Ltd., of Canada, gave Potter Aircraft Service, Burbank, Cal., the job of overhauling and re-doing the interior of its business *Lodestar*. Air Associates, Scott Aviation and Potter Aircraft teamed up to serve Federal. The *Lodestar* was equipped with a Scott fixed oxygen system, a Grimes rotating navigation beacon, Grimes hooded instrument panel lights, Goodyear tires and tubes, Exide batteries, Air Associate seat belts and Stanley vacuum bottles. The newly modified *Lodestar* now also features a stainless steel buffet and cocktail bar, complete with Air Associates historical aircraft glasses, indirect cabin lighting, a couch and tables. Home base for the airplane is Calgary, Alberta, Canada.

The Houston Lumber Company, Wichita, Kan., points with plenty of pride to its new Remmert-Werner Deluxe Executive DC-3. Feature of this airplane, passenger-wise, is concert music in flight, via tape recordings and the cabin speaker system. Austin Goodwin is Houston's pilot.

John Wayne, Warner Bros. film star, recently bought a Cessna 180 to facilitate shipment of film between Mexico and Hollywood in connection with location shooting of a picture Mr. Wayne is producing for Warner Bros. When the new Cessna is not in use ferrying either film or passengers, Capt. Leo Lopez, Mr. Wayne's pilot, is teaching his boss' two sons to fly.

International Harvester's Raoul Castro flew the corporation DC-3 (N-24H) to Mallard Industries, Bridgeport Municipal Airport, for cowl flap modification. Last month, the company's other DC-3, N-25H, was in for rudder tab modification and installation of a Grimes rotating beacon. International Harvester is a member of NBAA.

Douglas Aircraft has entered into a license agreement with Grand Central Aircraft under the terms of which Grand Central will manufacture spare parts and components for the Douglas B-26 (formerly A-26) which has proved to be especially adaptable to conversion to the requirements of business executives who want speed and range as well as the most modern equipment in the plane's cabin.

Goodyear Tire and Rubber Company has added a Cessna 180 to its fleet of aircraft. The plane has a full paint job, carrying Goodyear's colors and the famous Goodyear flag. The 180 will be based at Goodyear Field, Akron, Ohio.

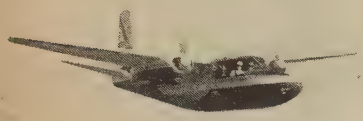
Joe Crane and Jim Manor are now flying a new Deluxe Executive DC-3 from Remmert-Werner for the Rich Wing Corporation of Detroit. The plane is powered by Super-92 engines and is equipped with Collins radio.

Jim Hopkins, chief pilot for American Can Company, brought the DC-3 to Mallard Industries for 100-hour check and installation of a Genesco vacuum oil separator to comply with specific AD notes.

Ted Pavell, chief pilot of the DC-3 owned by Allied Stores Corp., visited friends at Southwest Airmotive while the airplane was at Dallas with officials of the company.

Protect Your Investment*

BONANZA



AERO-COMMANDER

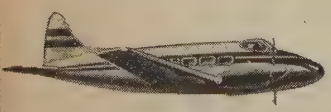
CESSNA 170

LODESTAR

CESSNA 195

NAVION

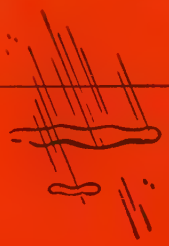
PIPER TRI-PACER



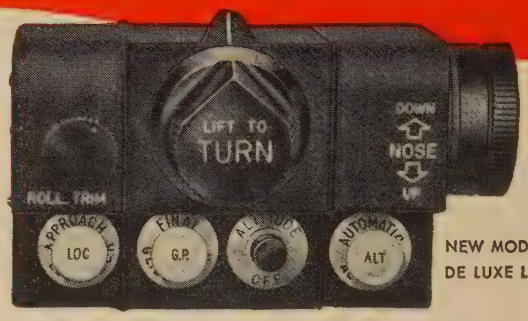
DOVE

BEECH L-23

DON'T FLY ALONE



LET THE LEAR L-2 FLY "CO-PILOT"



NEW MODEL 937 DE LUXE L-2 CON

Thousands of hours in the many hundreds of executive, military and professional planes prove that you don't have to "go it alone" when the *all-weather* Learpilot is backing you up. This multi-arm "co-pilot" does the flying for you—freeing you to concentrate on the complicated problems of navigation, IFR procedure, radio communication, bad weather, etc., etc., etc.... Learpilots are compact, light-weight—quality built throughout—can be installed at low cost.

Automatic Approach Coupler—when added to your Lear L-2 system automatically performs the very exacting task of locking your plane to the ILS beam, guiding it with precision right to the runway.

New Deluxe Controller—features a new automatic safety device that prevents sudden nose-down or nose-up flight attitude when the autopilot is engaged. This Model 937 controller is used with all Lear automatic approach coupler installations and is available for any Lear L-2 system.

Automatic Altitude Controller—a Lear L-2 accessory that automatically maintains your plane at a constant pressure altitude. Flip the switch to "ON" when you reach your desired altitude and that's where you stay!

See Your Lear Distributor—*he will be pleased to demonstrate the Lear L-2 autopilot to you—call him today. If you operate heavy, multi-engine planes on up through the DC-6 class, write to the factory for a Lear L-5 autopilot demonstration. An early appointment can be arranged.*

Nearly a thousand Lear L-2 autopilots are now "co-piloting" more than 21 different types of Executive planes ranging from Pipers to DC-3s. (Write for free illustrated booklet.)

Lear AIRCRAFT RADIO PRODUCTS
COAST TO COAST
Sales and Service

LEAR INC. LEARCAL DIVISION • 11916 W. PICO BLVD., LOS ANGELES 64, CALIF.

The Name Men Fly By... **AUTOMATICALLY!**

Grand Rapids Division, Grand Rapids, Michigan; Romec Division, Elyria, Ohio
Lear International Export Corporation • 9 East 45th Street, New York 17, N.Y.

Revised Newark Air Procedures

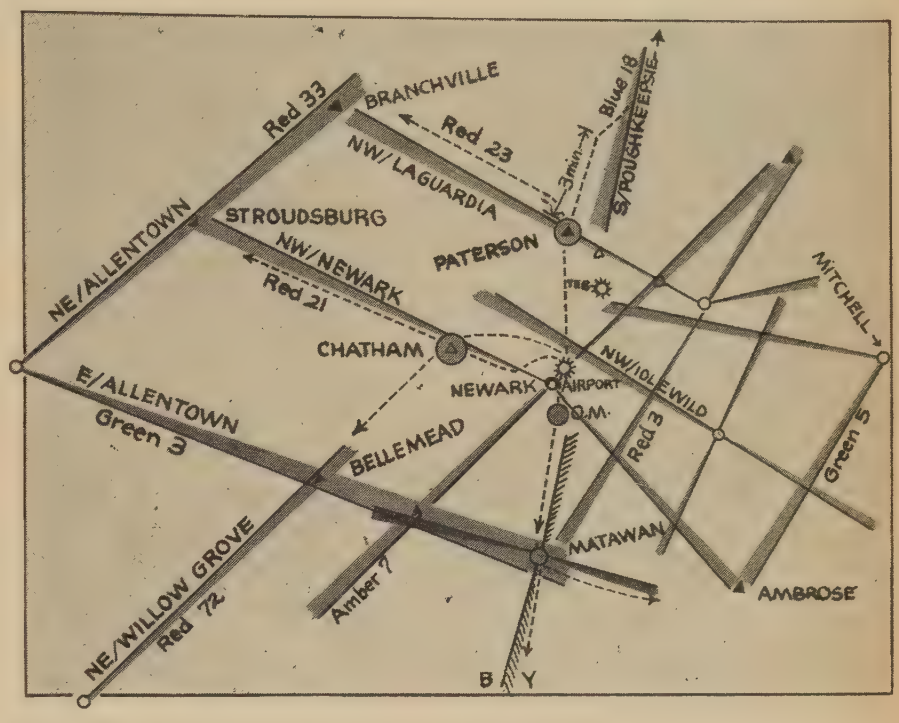
For the information of all pilots using Newark Airport as their base or New York terminus, thus avoiding the congestion at LaGuardia and Idlewild, certain new procedures and frequencies now govern the flow of traffic. Knowledge of and adherence to them will expedite the operation.

First, as at LaGuardia and other terminals, regardless of weather conditions all aircraft should make initial contact with Newark Approach Control listening in 126.5 mc, transmitting on same if possible or alternate standard tower VHF frequency. Approach Control will then advise the aircraft where and when to contact the "Tower" and the frequency to be used, primarily 118.3 mc. Normally, this will be over a well-known geographical landmark if VFR, or over the Outer Market if IFR. If the weather is "marginal" or on the borderline between VFR and IFR, the flight will probably remain on Approach Control until over the Outer Marker.

Radar approaches and advisories will normally be given on the localizer voice channel 110.3 mc, or alternate frequency if necessary.

For departing aircraft, the initial contact should be made on standard Ground Control frequency 121.9 mc. If unable to use this frequency, it should be made on standard tower frequency, specifying the frequency on which reply by Ground Control is desired. Taxi information and air route IFR clearance will be given on this frequency and the pilot will be advised to change to "Tower" 118.3 for take-off clearance. An aircraft departing IFR will be instructed to contact Newark Departure Control on 120.5 mc when off the ground.

Normally, a "short" clearance will be issued to departing IFR traffic who are equipped to handle on the required VHF channels of Departure Control and the New York Center. This clearance will specify only the clearance limit (usually a radio fix just outside the most congested part of the metropolitan area-see below), an altitude assignment at that fix (to cross at and to hold if necessary) and when necessary, the revised route to be expected beyond that clearance limit when ATC cannot approve the route requested.



FIX	ALTITUDE
Bellemead	2,000
	3,000
	4,000
Stroudsburg	3,000
	4,000
Branchville	3,000
Poughkeepsie*	3,000
Chatham	2,000
	3,000
	4,000 **
Paterson	2,000

(Clearances will specify climb to 3,000 immediately after passing Paterson).

** Aircraft proceeding to Poughkeepsie will be advised to remain on the west side of the south course of Poughkeepsie Low Frequency range until three (3) minutes north of Paterson.*

*** Flights cleared to cross Chatham at 4,000 will be instructed to remain on the south side of the west course of Newark LF range and not to climb above 3,000 until course is established on the south side of the west course of Newark. This affords separation between a Newark departure and departures west and southwest-bound out of LaGuardia crossing the northwest course at Idlewild at/or above 4,000. Were the Newark departure to be held at Chatham awaiting further clearance, the LaGuardia flight would cross the northwest course of Idlewild at 5,000.*

As soon as Newark Departure Control has established standard separation between successive departures and any other aircraft under their control, and the flight in question has reported leaving the last altitude before the assigned altitude, Departure Control will change the flight over to N. Y. Center frequency, advising the appropriate frequency which will normally be as follows:

Departure Route		Frequency
Paterson	Red 23 or Blue 18	124.1 mc
Chatham	Red 21	124.1 mc
Chatham	Red 72	125.3 mc

Further elaborating on these routings, flights cleared to Bellemead will be expected to proceed from Newark Airport direct to Chatham radio beacon, then via Red Airway 72 to Bellemead. To Stroudsburg via the northwest course of Newark LF range and to Matawan direct via north course. To Branchville via direct Paterson radio beacon, Red 23, and to Poughkeepsie via direct Paterson. and Blue 18.

(Continued on page 38)

Revised Newark Air Procedures

(Continued from page 37)

If such a "short" clearance would put the pilot over a fix and on an airway not specified in his original flight plan, the clearance will include a further routing from that fix which will shortly place him back on his originally intended route of flight when out of the congested New York area.

As with LaGuardia and other radar-equipped facilities, Departure Control will employ radar to maintain a minimum of three (3) miles horizontal separation between all departures, thus relieving the cumulative delays involved in successive departures under ANC/IFR standards, until such standard separation is achieved at or before crossing the clearance limit fix. Pilots, either unable because of equipment limitations or unwilling to accept radar separation, will be granted standard ANC/IFR separation without prejudice, but must necessarily suffer the time separation delay pursuant thereto.

Seminar on Executive Transport Operations Earns Pilot Applause

Recently, at East Hampton, L. I., N. Y., something relatively new but very successful was presented to the non-airline professional pilot. This was a seminar on the whole subject of problems confronting the business aircraft crew, and it was presented by Executive Air Transport Co. of Smithtown Branch, L. I., N. Y. With a few exceptions, a professional pilot who aspires to or has acquired the role of executive pilot ceases to enjoy the opportunity for further systematized advanced training in his highly exacting field. Unless he served as a scheduled airline pilot, his formal pilot training stopped when he attained his Instrument rating and/or his Air Transport rating.

Maintaining his proficiency depends on his willingness to seek and obtain additional Link trainer time and this usually consists of reviewing only the basic techniques. Few Link schools deal with advanced ATC problems, specialized area procedures, or IFR airway operations in complicated congested areas. On-the-job training in the hard school of experience is the norm for the non-airline professional pilot.

It was with this thought that Executive Air Transport made their offering at East Hampton. During the three-day program, a series of lectures and pilot discussion periods were held stressing such subjects as:

1. Weather as it relates to flight planning and to carrying on the flight.
2. Civil Air Regulations and Air Traffic Rules.
3. What the pilot is likely to encounter in entering congested areas.
4. Emergency procedures in common use, with the objective of working out procedures for the client's aircraft.
5. Use of Jeppesen and other Instrument Flight Charts.
6. Radio navigational aids.
7. Instrument flight—routine procedures, power control during an approach, special situations such as heavy turbulence, the instrument check, sensory illusions in flight, progress in cockpit, standardization and summaries of late developments.

Both hood and route checks were offered to crews on their aircraft if desired and time permitting. Various experts from several of the specialized fields touched on were present to comment and advise. Among them were Vern Peterson, executive vice president of Executive Air Transport and a senior Captain for EAL; W. B. Beckwith of UAL's meteorological dept; and John Moriarity of ATC.

In the navigational, communications and ATC discussions, review of VOR's, VAR's, DME, ILS, GCA, and

Air-Aids Spotlight

ALBANY, N. Y.—*Frequency of the ILS Outer and Middle Compass Locators is 219 kc and 201 kc respectively. Check forthcoming C&G and JEP charts for altitudes.*

BEAUMONT, Tex.—*New Combined Tower–INSAC operates on 272 kc and 119.5 mc primary frequencies—tower answers to "Jefferson County Tower."*

CHARLOTTE, N. C.—*Alternate Missed Approach procedure on new ILS allows straight-out climb on Northeast ILS course to 2200 ft. within 25 miles. New minimum as alternate: 600 ft. and 2 miles visibility.*

CANADA—*Towers only guarding both 3105 kc and 3023.5 kc. Ranges guarding 3023.5 kc.*

OTTAWA, Ont.—*Tower now taking visibility observations, similar to many U. S. towers.*

FLORIDA *Area—Blue Airway 75* MIAMI *direct* TAMPA *replaced by Red 101.*

IDLEWILD, N. Y.—*New TVOR to be installed serving three principal runways. Watch AirGuide for frequency.*

KNOXVILLE, Tenn.—*Interference from N. Chattanooga MHW ("CQN" on 215 kc) limits safe use of Knoxville ILS Outer Locator to 20 miles ("TY" on 217 kc). Localizer due back.*

NEW YORK—*Another frequency swap.* CENTER *dropping 125.5 mc, picking up 125.3 from LGA tower. Also 125.5 to LaGuardia for radar, losing 120.3 account interference with Boston Center. New York Center soon to guard 122.1 on request.*

PHILADELPHIA, Pa.—*New Local aeronautical chart of Philadelphia and vicinity is No. 22 in the series.*

SAN FRANCISCO, Cal.—*Tower Airport Surveillance Radar on 120.9 mc commissioned. VFR flights make initial call to Tower on 119.1 mc; IFR flights to Approach Control on 118.5 mc. (Nationwide inconsistency on initial call practice due to local conditions would be only minor matter if some indication or code on charts guided pilots rather than fine print in AirGuide).*

SPRINGFIELD, Ill.—*Combined Tower-INSAC operating 0700 to 2300 only, on 120.7 and 121.9 mc plus INSAC freq.*

WASHINGTON *Area—Red Airway 45 DCA to BAL now starts from RIVERDALE radia beacon on a 63° track to intersect South course of Baltimore range at Severna Park.*

BINGHAMTON, N. Y.—*Tower low frequency now 332 kc.*

EL CENTRO, Cal.—*Low frequency range on this "low level" route into Los Angeles area from East now on 329 kc.*

Ed—Check Air Guide, Radio Facility and Jeppesen charts for other frequency changes when planning route to be flown.

adar Vectors was the main theme, eir use and techniques for the pilot. n the subject of ATC procedures, overing Approach, Departure and olding procedures, "Moe" Moriarity, upervising District Specialist for the ew York area, CAA First Region, as the outstanding speaker and he nswered many questions of the pilots.

Another speaker was Mike Lepanto, flight Engineer for UAL and former- a mechanic. Mike covered power- lant failure, electrical and hydraulic ystems troubleshooting.

Much credit for the success of the eminar belongs to Harry Van Liew, resident of EAT and a Senior Cap- ain on United Air Lines, who reports lans for EAT's second seminar (Oct. 0—Nov. 1) are nearing completion; his one to be held at Greenwich, Connecticut.

GE Airport Radar Installations Speeded

The new and improved GE ASR-2 Airport Surveillance Radar installa- ions at 16 airports throughout the ountry are either commissioned or in he process at this writing. At seven ther airports work is going forward, omewhat hampered by the problem f CAA economy budget which may eventually eliminate many installations ow planned.

The new equipment, designed to give the associated control tower the ocation and flight path of all aircraft within a 30 to 60 mile radius regard- ess of weather, has been installed at Newark, N. J., Philadelphia, Pa., De- roit, Mich., Norfolk, Va., Houston, Texas, Jacksonville, Fla., Indianapolis, Ind., San Francisco, Cal., Birmingham, Ala., New Orleans, La., Pittsburgh, Pa., Oakland, Cal., Memphis, Tenn., Portland, Ore., Kansas City, Kan., and Dallas, Tex.

It is currently being installed at Columbus, O., Cincinnati, O., and Seattle, Wash. Awaiting installation are Minneapolis, Minn., Salt Lake City, U., St. Louis, Mo., and Milwau- kee, Wis. GE also will supply the radar system for airports in Anchorage, Alaska and Honolulu, Hawaii.

During periods of low visibility, the new ASR-2 will be operated in conjunction with the airport's other precision approach radio aids. Because landings under poor visibility require more time than normally, the new radar helps control personnel space and the arrival of aircraft so that they can be "fed" into the approach at the safest and most efficient rate.

As in other late types of ground radar, only moving objects show on the radarscope. Inasmuch as the radar antenna is sweeping the air above the ground, such targets must necessarily be aircraft and they are not blocked out by reflections (known as "clut- ter") of stationary ground obstructions. Superimposed over the scope face are transparent overlays on which ap- propriate maps of the area scanned are inscribed with primarily the per- tinent navigation aids plus prominent landmarks and other aeronautical data useful in orientation both of the scope and flight assistance.

The new radar has been designed to insure continuous 24-hour opera- tion and includes duplicate "standby" equipment which can take over instantly in case of electrical or mech- anical failure of the primary equip- ment, and which operates on a separate channel so that maintenance or repair can be performed on either set without interference to the operational set. Antenna, transmitting and receiving equipment is remoted from the tower, enabling the most effective location within two miles to be employed while picture information is carried to the tower indicators via coaxial cable.

As with all other radars, there are certain natural and inherent limita- tions, such as lack of altitude infor- mation, target identification, small "blind" spots and precipitation interference, but as a traffic-control aid, giving factual azimuth and range informa- tion to all points of the compass, enabling unlimited track and course guidance, virtually visual separation from other aircraft, etc., it has no peer in either pilot or ground equipment.

LaGuardia Installs RR Grade-Crossing Gates

Transient pilots landing at La- Guardia have been doing a "double- take" when taxiing on the west side of that field. The Port Authority, always one for novel ideas, has solved the irritating problem posed by the necessity for aircraft to taxi west-bound to the Butler hangar and service facilities. The PA has installed RR-type crossing gates and traffic lights on the taxiway intersecting the 85th st. access road to the Marine Terminal.

Before this installation, it was necessary for pilots to shut down engines and be towed across the road, a de- laying procedure. Under the new sys- tem, pilots wishing to go to the Butler facilities will taxi to the intersection and stop at the Hold line where a Stop sign is installed and wait for the guard to take the necessary action with the gates and light to insure safe passage under power.

Priority is given to westbound traffic on the taxi way.

Photo Credits

Pages 9-10—NBAA; 12-13-14—Levy-Shipp; 17-18—Pacific Airmotive, Atlantic Aviation; 19—CAA; 20-21-22—Wide World for SKYWAYS; 23—Levy-Shipp, Groenhoff; 24-25—Levy-Shipp, Cessna; 26-27—Levy-shipp, Piper, Bell Rockwell; 32—Lear; 34-35—Cessna, Groenhoff, CAA.

Contract Overhaul

(*Continued from page 18*)

stock. Primed surfaces should be degreased and cleaned prior to painting.

Engine Preservation: During the time that the airplane is confined to overhaul operations, the engines should be subjected to a preservation run-up and should be re-preserved at the end of a 30-day period. Upon completion of the overhaul operation, the engines should be de-preserved.

Corroded Metal Areas: Exterior or interior areas where corrosion is prevalent should be etched and cleaned prior to priming with zinc-chromate primer. Areas adjacent to the heater induction manifold, engine exhaust manifold, or drain lines should be spray-painted with aluminum lacquer after etching, cleaning, and priming.

Airworthiness Directive Items: Compliance with these directives is mandatory under the CAR. Where this work has been partially accomplished or previously accomplished, a complete inspection record should be made and given to the customer, and items not complied with should be done.

Low-Time Engines: Unless specified, low-time engines are normally not removed at overhaul. However, a conventional 100-hour engine check should be performed and inspection discrepancies corrected before they are preserved. No removal of accessories should be made on the engine firewall for low-time engines. Vacuum oil separators should be flushed, and engine cowl flap bushings replaced where worn.

Low-Time Propellers: What is applicable to low-time engines is also applicable to low-time propellers. The dome of the propeller hub should be desludged. A conventional propeller check should be performed and discrepancies corrected. The engine thrust nuts should be checked for proper torque. The de-icer boots should be replaced as per the inspection discrepancies. Painting and finishing should be done as per the inspection discrepancy.

Overhaul of High-Time Engines: High-time engines should either be overhauled in compliance with the manufacturer's specifications or exchange engines installed of the same dash-number as specified for the particular type of air transport.

Overhaul of High-Time Engines: High-time engines should be removed and completely overhauled in conformity with manufacturer's specifications and the CAR. Propellers should be painted and cadmium-plated so they are equivalent to a zero-hour propeller.

Overhaul of Engine Mounts: Where the engines must be overhauled, the engine mounts should be checked for alignment, the attaching bolts replaced if worn or in excess of the CAA hourly limits, and the mount should be cleaned, carefully sand-blasted, and then painted. The shock mounts should be checked for wear as per inspection discrepancy. Engine mount bolts with less than the allowable time on high-time engines should be magnetically inspected and replaced only on inspection approval.

Magnetic Inspection: All critical ferrous parts of the landing and nose gear assemblies should be magnetically inspected.

Zyglo Inspection: All outer-wing attach ment fittings as well as center section wing-fuselage fittings and bolts should be inspected by means of Zyglo inspection, and bolts should be replaced when the airplane hours exceed 8,000.

Capping of Fluid Supply Lines: All fluid air, lines should be capped upon removal of the functional parts, or where outer wing panels have been removed.

Control Cables: Cables must be taped securely and tagged where control surfaces have been removed. In compliance with the CAR, cables must be replaced where swaged fittings have failed or where the cable has frayed beyond what is considered the safe limit.

Pilot's Control Pedestal: The pilot's control pedestal must be reconditioned although left intact. It must only be removed when specified or where overhaul makes it imperative it be removed.

Control Knobs: All control knobs in the flight compartment should be removed to prevent loss, and made accountable. The knobs must not to be reinstalled until the airplane is ready for final inspection.

Inspection Access Plates: Wherever inspection access plates must be removed, these must be tagged for identification to facilitate replacement on the same access opening.

Headlining and Interior Fabric: Interior headlining, side wall fabric, insulation and

(*Continued on page 43*)

Contract Overhaul

(*Continued from page 40*)

or by inspection discrepancy. Repairs must be accomplished as directed.

Auxiliary Powerplant: Auxiliary powerplant overhaul should be accomplished after removal from the airplane. A performance and run-up test must be made.

Hydraulic Filters: Hydraulic fluid filters in the reservoir should be replaced.

Hydraulic Fluid Pressure Accumulator Diaphragms: Unless the flight time on the pressure diaphragm is known, a new diaphragm should be installed.

Hydraulic Pressure Flexible Supply Lines: These hoses should be removed and pressure-tested for satisfactory operation. Defective hoses or fittings should be replaced. The end fittings should be checked for security and proper thread meshing.

Control Surface Fabric Covering: Fabric-covered control surfaces should be recovered on inspection only. Complete recovering should be accomplished after all sheet metal repairs have been accomplished. Trim-tab mechanisms should be checked and control surfaces should be statically balanced after finishing the fabric. They should be stenciled with the date of recovering and specification.

Functional Accessory Parts: All functional accessory parts must be subjected to an operational check prior to attachment of the serviceable-parts tag. The operational test must be performed in the presence of an inspector. Certain functional accessory parts may be left intact, these being subject to an inspection check if found to be suitable for additional flight operation, subject to "on condition" maintenance.

Engine Oil Tanks: On high-time engines, the oil tanks should be drained, removed, and steam cleaned internally and externally. On low-time engines, the oil tanks should be drained and steam cleaned internally and externally, but left intact on the engine nacelle.

Instrument Panels: Instrument panels should be removed by section and disassembled in the instrument shop on a major overhaul operation. Instruments having low flight hours are not removed except on inspection discrepancy. Instruments, when removed, should be overhauled per the manufacturer's standards and in conformity with the CAR requirements. All instruments should be tested and calibrated prior to reinstallation.

Electrical Solenoids: Electrical relays, if defective or inoperative, should be replaced with new parts of identical type.

Replacement of Airframe Parts: Airframe parts which require replacement should be replaced with parts made by the airplane manufacturer. When delivery of spare parts from the airplane manufacturer is delayed, these parts should be fabricated locally with the owner's approval and in accordance with the manufacturer's drawings and process specifications.

Stencils: All external stencil marks should be replaced as per the original configuration on the airplane upon its arrival at the overhaul base.

Wing Integral Fuel Tanks: Sheet metal repairs for the tanks should be made in

(*Continued on page 45*)

Embry Riddle

Gives your career a flying start!

There's no ceiling to advancement for men qualified to do a job in aviation! Embry-Riddle accredited graduates are wanted by the entire aviation industry. For the fastest way to get complete training . . . to live, study, work and play in South Florida's perfect year-'round climate . . . write for complete information, NOW!

AVIATION ADMINISTRATION

Full, four-year University of Miami business administration degree course, with emphasis on aviation management. Flight instruction conducted by Embry-Riddle.

EXECUTIVE-PILOT

Embry-Riddle two-year business course, including aviation management, at University of Miami. Leads to Commercial Pilot Certificate with Instrument and Multi-Engine Ratings, plus thorough training in Aeronautical Technology.

COMMERCIAL PILOT

Best instructors, up-to-date aircraft, superb year-'round flying conditions, experience gained with 30,000 students.

A & E COMBINED WITH COMMERCIAL PILOT

Embry-Riddle *combination* training gives you aviation's greatest opportunities. Airmen with dual pilot-technician ability urgently needed.

AIRCRAFT & ENGINE MECHANICS

Properly trained A & E Mechanics always in demand. Embry-Riddle students learn fast, with modern equipment, including jet . . . live aircraft.

INSTRUMENT FLYING

Dual instrument as well as Link Trainer, navigation, instruments, radio and navigational aids, and instrument flight procedures . . . all to qualify you as Instrument Pilot.

TRAINING AUTHORIZED UNDER G.I. BILLS

MAIL THIS COUPON TODAY!

Dean of Admissions—Dept. 93
Embry-Riddle School of Aviation
Miami 30, Florida

Please Print

Name_____

Address_____

City_____

State_____ Age_____

I am interested in . . .

- ☐ A & E Mechanic
- ☐ Commercial Pilot
- ☐ A & E Combined with Commercial Pilot
- ☐ A & E Combined with Private Pilot
- ☐ Instrument Rating
- ☐ Aviation Administration
- ☐ Executive-Pilot

Check One ☐ Veteran ☐ Non-Veteran

Embry Riddle
International
SCHOOL OF AVIATION
MIAMI 30, FLORIDA
TRAIN IN MIAMI
AIR CAPITAL OF THE WORLD

Contract Overhaul

(Continued from page 43)

conformity with a customer-approved fuel-tank leak chart. Where the sealant is defective, an approved method of stripping the sealant should be used. Resealing should be accomplished by an approved process selected by the customer. Simple repairs must be made in approved manner.

Functional Inspection Checks: The final inspection should include functional and operational checks of all systems of the airplane, engine, propellers, landing gear, control surfaces, and accessories. Radio reception and transmission tests should be done on prior test flights.

Anticipated Overhaul Costs: The final cost of repair or overhaul of an air transport is seldom made on a flat-rate basis. Numerous variables usually affect the outcome of the estimated costs, hence the need for a basis of control of costs. Another reason for the prevalent time-and-material method of cost analysis is the failure of overhaul centers to establish efficient cost control so they know whether or not they can show a profit by quoting flat-rate costs on overhaul.

Usually, the final cost is predicated on the accrued costs of the expended direct and indirect labor, indirect material, direct material supplied, as well as the new or serviceable parts installed. This is a sound foundation to determine final costs, provided the customer has access to all time cards and cost vouchers. However, with the tendency toward competition, the trend is toward the flat-rate basis.

There exists a difference in man-hour labor rates at the East and West Coast overhaul centers, the higher labor prevailing on the West Coast. However, the percentage of overhead applied to the hourly labor rate may also vary from one overhaul center to another. In general, 100% overhead cost is applied to the hourly labor rate, although it may sometimes be higher than this amount. For example, in some overhaul centers, supervisory personnel are carried on administrative overhead expense, whereas in other plants these personnel are charged against the job as direct labor. This affects the total hourly labor rate. It is something that the prospective customer should determine prior to signing a contract for plane overhaul. Another item of extra costs is engineering time expended in the design of modifications. This cost, too, should be negotiated prior to signing a contract. Design costs cannot be considered as administrative or overhead items.

The foregoing general and detail specifications should serve as a guide to the contractor as well as to the customer. They perform the mission of clarification of items of contention between customer and contractor and also serve to show what is expected of the contractor, and a norm to control the expenditure of man-hours. While it is recognized that these specifications may not be applicable to all air transports, they do establish the basis of final cost. Thus, they perform a dual function. The corporate owner is pleased with the work and the contractor has been allowed to perform a profitable work assignment without disagreement when the final invoice is submitted to the plane owner.

Refresher Training

(*Continued from page 15*)

at top proficiency with an occasional check flight by another pilot," Capt. Ueltschi explained. "Personally, I've never met a man smart enough to spend two hours in a cockpit with another pilot and come away knowing the true ability of the man he was checking."

A few of the larger airlines had developed an organized approach to the problem of training and maintenance of proficiency. But the cost of such programs was high, even for the smaller airlines.

And yet the need was as great or even greater. A business pilot is a whole airline organization rolled into one man, Ueltschi points out. He is often transportation chief for his organization, and solely responsible for the efficient use of his boss's time. He must be prepared to fly anywhere at any time, frequently over routes with which he is not familiar and into airports with only the most basic facilities. He usually serves as his own dispatcher, his own meteorologist, and occasionally, as his own mechanic. He must have confidence to resist any pressure, direct or implied, to compromise safety.

Part of the answer was a long and careful job of adaptation of the training programs of not just one airline but of many, culling out the best ideas and techniques and moulding them into a program specifically adapted to the requirements of the business pilots.

Long ago, it was discovered that a pilot could not keep up his proficiency merely by continuing to fly airplanes. A man slips easily into bad habits and it was scientifically determined that these bad habits creep up on a man unconsciously. Only an organized training program run by men skilled in instruction and in the analysis of flight techniques and procedures can usefully contribute to the maintenance of proficiency. From this knowledge came the law that now requires all scheduled and non-scheduled pilots to participate in refresher training programs.

With all these ideas firmly in mind, Captain Ueltschi set about recruiting a staff for his Flight Safety, Inc.

One of his men is Heaton B. Owsley, vice president of Flight Safety, who began his aviation career at the University of Michigan, where he obtained his degree in Air Transport Engineering. Later he specialized in Airline Dispatching and Meteorology at the Boeing School of Aeronautics operated by United Airlines at Oakland, California. For nearly 20 years, he has worked on airline meteorological and dispatch problems, becoming one of the very best in his field. As planes flew higher and faster and further and needed more weather data, he helped with the research that improved the meteorological art to meet the increasing needs.

Superintendent of Flight is Capt. William P. Person, former manager of the Air Transport Division of Flight Safety Foundation, Inc., a non-profit organization devoted to the advancement of safety in all forms of air transportation. A veteran pilot with many thousands of hours to his credit in various types of past and present airline equipment, Capt. Person has been a flight instructor and an Assistant Chief Pilot for American Airlines.

The experience of these men and others on the staff, according to Ueltschi, adds up to one thing: professional background as teachers. He emphasizes again that there is a human element in flying safely that cannot be properly met with brief checks. "We are teachers, not checkers," Ueltschi says. The instructors are designated by the CAA as airline transport examiners.

The key piece of ground equipment owned by Flight Safety is an electronic trainer which is basically a Link fitted with a Dehmel automatic radio aids unit. With this new unit, Flight Safety is able to give practice on the ground in all the radio navigational problems.

A pilot gets no simple rehash of elemental instrument flying when he enters the Flight Safety trainer. Emphasis is placed on his ability to handle the unusual. He may find himself faced with a communications failure while holding at Holmes Intersection or he may be forced to execute a missed approach procedure while over the Middle Marker on "final" at Chicago due to some trouble on the runway discovered by the tower (training instructor). In this way, pilots become proficient in meeting the problems which demand maximum skill under the worst conditions.

Flight Safety's electronic trainer is the first to incorporate the standard arrangement of instruments recommended for the cockpits of future transport aircraft by the Cockpit Standardization Committee S7 of the Society of Automotive Engineers (*SKYWAYS, December,* 1952). This proposal has also been adopted by the President's Committee on Aeronautics. Pilots at Flight Safety are today using the instrument layout of tomorrow. Some have already made plans to change their own aircraft instrumentation to conform with this carefully prepared arrangement which takes into account the proper correlation between instruments used during various phases of instrument flight. Even the color contrast between the panel and the instruments follows the recommendation to reduce eye fatigue and increase accuracy. The instruments themselves are the conventional ones in present-day aircraft such as RMI, ILS. VOR, VAR and ADF, all indicating automatically according to the pilot's position and altitude.

Crews are trained in their own airplane, but it is not always necessary to take an aircraft out of service for the entire period of the training. Flight Safety's program can often be dovetailed into a corporation's operating schedule.

The program is in two parts, initial training which takes an average of seven days per crew, and the refresher program at six months intervals which takes about four days. Although the contract for the initial program does not obligate a corporation to continue with the refresher program, most corporations, once exposed to Flight Safety, have made it a permanent part of their training program and the crews return for refreshers.

Ground training includes a thorough

(*Continued on page 48*)

AT SPARTAN...

Your Airplane is *Always* in GOOD HANDS

In seeking a source of repair, overhaul or conversion for your aircraft, you undoubtedly look for three things:

1. Craftsmanship
2. Speed of Completion
3. A Fair Price

SPARTAN 25th ANNIVERSARY 1928 ★ 1953

You get all three at SPARTAN — a firm that for 25 years has grown with the expansion of aviation. From those early days when the work consisted of keeping the Company's customers' planes and a few itinerant aircraft flying to the present highly complex business aircraft, SPARTAN'S shops and equipment have expanded. Today, the engine overhaul plant alone represents an investment of a million dollars and processes an average of 150 engines monthly.

Discuss your projects for repair, overhaul or conversion with SPARTAN.

SPARTAN AIRCRAFT COMPANY

AVIATION SERVICE DIVISION

MUNICIPAL AIRPORT
Repair Station No. 50
TULSA, OKLAHOMA

MERCER COUNTY AIRPORT
Repair Station No. 3530
WEST TRENTON, NEW JERSEY

Refresher Training

(*Continued from page 46*)

checkout on the performance characteristics of the airplane and its limitations, especially at take-off. Best speeds and power settings are established for take-off, climb, normal cruising, high-speed cruising, and maximum endurance cruising. Single-engine performance is carefully evaluated, as are fuel consumption, fuel required, radius of action and emergency procedures.

Under meteorology, Flight Safety reviews the ways of getting the maximum amount of weather information and the procedures for keeping posted on weather in flight, weather conditions that cause most trouble, and recent developments with respect to icing and thunderstorms.

Flight Safety also undertakes to keep the pilot abreast of the constantly changing air traffic control picture, the net result of which is the avoidance of excessive holding time over destinations. Simulated flight includes problems involving all the instruments and radio navigational aids.

Flight training includes over 50 individual items. Preflight includes visual inspection, use of check lists, engine starting procedures, taxiing, engine run-up and setting up radio equipment.

Under take-off is included procedures for engine failures, crosswind conditions and instrument conditions.

The airwork establishes such standards as performance in climbs, steep turns, approach to stalls and recoveries, recovery from unusual attitudes. There is also a demonstration of minimum control speed with one engine out, rapid descent and pull up; landing and approach patterns at altitude with both normal and unbalanced power and maneuvering with one engine out.

Instrument navigation is stressed including such matters as radio equipment familiarization, DF orientation and time out checks, ADF tracking toward and away from station, standard range approaches, ILS bracketing and approaches, VOR navigation and letdowns.

Under "emergencies", standards are set for feathering and unfeathering, engine, heater and cargo compartment fires, smoke removal, emergency flap and landing gear operation, hydraulic-pressure failure, fuel dumping, electrical and fuel-system failures and the use of oxygen.

Standards for landings include normal landings, the engine-out configuration, with a crosswind, with weather minimums, with zero flap, emergency-brake operation and refused landing.

At the end of the course, the pilot takes home with him a manual, copyrighted by Flight Safety, on operating and emergency procedures for the particular plane used. The manual includes check lists, a summary of the manufacturer's claims for the aircraft updated with the latest available information and the syllibi of the ground, instrument trainer and flight courses.

Captain Ueltschi points out that the program is flexible enough so that some parts of the course may be more heavily emphasized than others, depending on the particular needs of the crews. Thus, time

(*Continued on page 50*)

What's my cruising range?*

*SHELL AIR FACTS

Air transportation is efficient:

The energy in a single gallon of aviation fuel will move a one-ounce letter 350,000 miles by air, based upon the performance of a typical mail-carrying transport.

It's a fact, too—

Shell Aviation fuel carries the most air mail... the most freight ... the most passengers in the United States today.

SHELL OIL COMPANY

50 WEST 50TH STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

SHELL

Refresher Training

(*Continued from page 48*)

is often spent on special operating problems of the crews. Because of this, it is difficult to give a breakdown of the time spent by crews in various parts of the course. However, of the 50 crews trained so far, the time spent has averaged about as follows:

For initial training the typical crew spends about 55 hours—15 studying the performance of the aircraft, meteorology, air traffic control and navigation, 20 in the electronic trainer, five in preflight briefing and 15 in flight.

Refresher courses take about 33 hours—eight on performance of the aircraft, air traffic control and special operating problems, 12 in the electronic trainer, three in preflight briefing and 10 in flight.

Flight Safety's list of customers is beginning to sound like a blue chip investment portfolio. Among them are Brewster Construction Co., Burlington, Mills, Eastman Kodak, Cornell-Dublier, Executive Aircraft Corp., Coca-Cola, Food Machinery and Chemical Co., Gulf, General Tire, Hercules Powder, Hollingshead, Ideal Cement, Kimberly Clark, National Dairy Products, National Distiller, McLean Trucking, Outboard Marine and Mfg. Co., J. P. Stevens, The Texas Company, Triangle Conduit and Cable Co., and Union Carbide.

An interesting recent development is service to airlines. Avianca, the Colombian national airline, and Icelandic Airlines as well as Pan American, have contracted for all or part of the program.

Word gets around fast in the business fleets. More and more pilots are dropping in to talk about the program. One crew has now completed its fourth refresher course. "They may come in skeptical, but they go out salesmen for Flight Safety," Captain Ueltschi says with pride.

"The reason for this is not just enthusiasm for the course. Pilots tell me that they see something more in Flight Safety. The business pilot is a member of a profession that has expanded so fast that the terms of reference are often a little vague. Some companies give more recognition to the men who fly their planes than others. If, through Flight Safety, the standards can be made uniformly high, the recognition will also be uniform and business flying will be more useful than ever."

Flying the ADIZ

(*Continued from page 19*)

one of the defense zones cannot be identified through the information received from ATC, radar or the civilian spotters, that plane must be assumed a foe. In such cases, fighter aircraft are dispatched immediately to intercept the unidentified airplane to make positive identification.

Above all, do not fly evasive action if, for any reason, you are unidentified on entering an ADIZ and fighter planes are sent up to intercept you. Also, if interception occurs at night, put on every light you can think of . . . illuminate yourself.

Communication is also of vital importance in flying the ADIZ. If you are on an IFR flight plan, don't leave the filing of that flight plan to chance. Take the time and the twenty-five cents to telephone the nearest CAA facility and file your flight plan, making sure your routes both into and out of the ADIZ and your intended point of landing are definitely established before you take off. Once you are airborne, make certain that your point of entry into the ADIZ is as you planned and reported to the CAA it would be.

If, because of weather, a deviation in your plan is in order, get on 126.7 immediately and make known to ATC your change of routing and the reason for this change. Also, if your point of intended landing is changed either because of weather or because of a change in itinerary, let ATC know that immediately.

Any pilot flying into an ADIZ should make absolutely certain his navigation aids are in perfect working order. If the pilot's intended course skirts an ADIZ, all of his cockpit aids to navigation are of prime importance. Any slight error of navigation that takes an aircraft over an ADIZ boundary may well mean an interception.

A pilot flying a defense zone VFR should always file a DVFR (Defense Visual Flight Rule). Here again, as with the IFR, do not deviate from your route. And if you have to change your flight plan, communicate by radio with the nearest CAA facility and inform them of your change and the reason for it.

If flying through an ADIZ without an intended landing, it is always a good idea to advise ATC, when you are 100 miles out, of your estimated time of entry. And upon entering the ADIZ, advise ATC of your estimated time of departure. In many cases, such as within the Minneapolis ADIZ, your flight might be a direct one from Point A to Point B where there are no radio facilities. In such cases a good plan is to call the ATC that's closest to the geographical point at which you plan to enter the ADIZ, tell them your course through the zone, your speed and the geographical point at which you expect to leave the defense zone. Always plan to be within five minutes, one side or the other, of your estimated time of entry and departure, and keep your flight path within 10 miles, one side or the other, of the center line of your reported course. This gives a pilot a fairly wide margin of error and it is generally felt that most pilots can keep within these tolerances.

Many pilots today are inclined to consider this whole security set-up of nuisance value. However, it would be well to remember that if the international situation were to become more tense, what today is an intercept and identification could become an intercept and a kill! It, therefore, behooves every pilot to discipline himself to carry out the basic principles of perfection flying. That calls for 1) a detailed flight plan, with the proper authorities in possession of a copy; 2) adhering to that flight plan or, if necessary to alter it, keeping the CAA facilities informed of the change and the reasons for it; and 3) closing the flight plan when the flight has been completed.

SKYWAYS FLIGHT OPERATIONS ROUND TABLE

Skyways Round Table

(Continued from page 22)

to the limit of its ability to build a more advanced aircraft, and to meet these requirements, it has to carry on some applied-type research. Therefore, in the course of the normal development of a specific aircraft or weapon, industry does uncover new or perfected applications."

Dollars Devoted to Research

Mr. Littlewood: "*At this point, gentlemen, I'm going to refer again to Dr. Furnas. He says, 'For the year 1952 the research and development expenditures for the U.S. including atomic energy, actually exceeded* $3,000,000,000*—roughly 1% of the gross national income.' Dr. Furnas states that this expenditure seems to be about the right proportion. On an average, companies spend about 1.6% of their sales dollar on research and development; the chemical and petroleum industries average about 2%. Dr. Furnas goes on to suggest that there is need for increasing the proportion spent on fundamental research.*

"Mr. Ramsaur, how does AiResearch determine what percentage of what amount should be devoted to research, and is AiResearch looking largely at the solution of immediate problems or further ahead to the development of ideas for a future industrial program?"

W. R. Ramsaur (*Vice President-Engineering, AiResearch Mfg. Co.*): "Mr. Raymond and Mr. Lear summed up the role of the equipment industry. We do depend upon organizations such as NACA and universities such as Cal Tech for basic research. However, when we get a job to do, it's 'research development unlimited' until that job is done.

"To answer your question specifically, Bill, I would say that AiResearch spends between 3% and 4% of its sales dollar on research and development, and a portion of that expenditure sometimes continues until the accessory has almost reached the point of phasing-out in service with the user."

Mr. Littlewood: "*Is that higher percentage than Dr. Furnas mentions because of the youth of your activity and the need for greater knowledge, all of which might decrease as time goes on and you become more settled in your field and turn more to production?*"

Mr. Ramsaur: "Yes. The accessory industry is comparatively young, and more important are the ever-increasing performance requirements for accessories as aircraft reach higher speeds and altitudes. This leads to a relatively higher cost in research, development, and laboratory facilities required by the accessory manufacturers, over that of general industry.

In addition, we do anticipate the future requirements and solutions which may or may not come into existence."

Mr. Littlewood: "*In other words, part of that 3% or 4% is devoted to long-range research which may or may not lead to anything definite.*"

Mr. Lear: "From the other hardware people here I'd like to find out their estimate of the percentage of the total amount of research and development they spend on *pure* research."

Mr. Littlewood: "*Mr. Webb, I wonder if it would not be valuable for you, representing the Aircraft Industries Association, to suggest a survey of your members to determine the methods and yardsticks they use. This is a question which comes up at every Board of Directors meeting when the Board approves the budget for the year. How much to be spent on advertising, etc? It usually is resolved to be a percentage of gross income.*

Dr. Furnas refers to percentages of gross dollar intake, and he finally ends up by saying, 'In summary, the national research and development program is vigorous and is probably about the right size.'

"That's a pretty definite statement, but how did he reach that conclusion and how do companies individually reach their conclusions? There must be some applicable yardstick."

Mr. Webb (*Vice Pres., AIA*): "It's a question that perhaps a survey can answer, and I'll undertake to get something along these lines."

Dr. Millikan: "In making any such estimate of the proper amount that should be devoted to research, to development, and to evaluation, there's one element that is important and often overlooked—that has to do with personnel, the composition of the team which is set up to perform any of these functions. Starting with evaluation, it seems to me that to be really good in the evaluation job, a team has to have among its members several persons with a real understanding of and an appreciation for development problems as well as some appreciation of the research problems.

"Mr. Raymond has said that the first thing industry does is to evaluate the status of research as it applies to the particular problem. In order to properly do this evaluation, men who have a real understanding of research must be available. You aren't going to get that type of man on your team unless you give him an opportunity to do some work in research.

"Conversely, a research group is often stimulated and does better work when it has some contact with development.

"Therefore, in determining how much research a development organization should do, one should always remember that there is some of what might be called 'non-immediately productive' research which has to be done in order to get the most effective organization and team working."

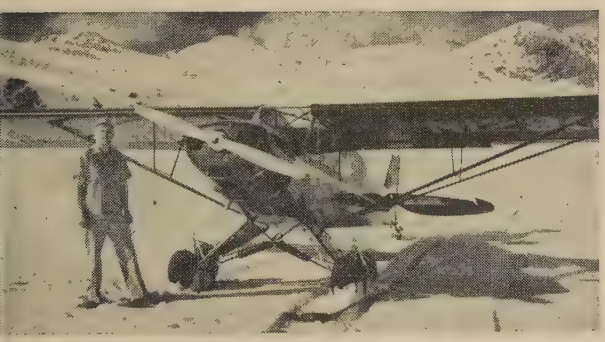
Mr. Littlewood: "*As Hugh wrestles mightily each year with appropriations committees, perhaps he can tell us on what basis he justifies the proposed budget for research by NACA.*"

Dr. Dryden: "In general terms, the NACA budget is dependent largely on the technical and international atmosphere which determines whether we should be doing more work or less.

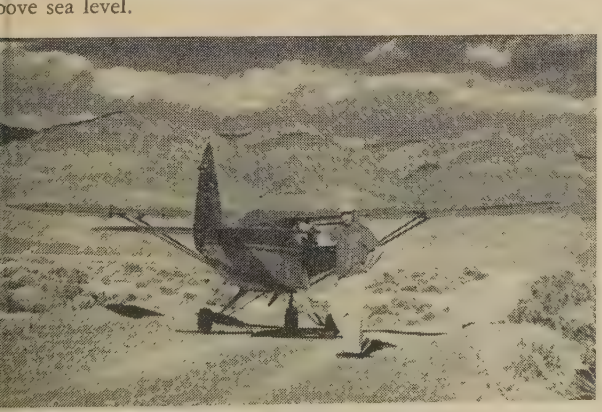
"To come back to the quantitative picture, I'm afraid that most people who read the figures of money available for research

(Continued on page 54)

"BEST MOUNTAIN AIRPLANE I'VE EVER SEEN"



THE SUPER CUB'S HANDLING and climbing abilities at high titudes, coupled with being able to land in such tiny places nake it the best mountain plane I've ever seen," says Bob Symons nown here at Paradise Lake in the high Sierras at 11,500 feet bove sea level.



VITH THE TRI-PACER'S TRICYCLE GEAR and short span, Mr. Symons ports, "almost every country road becomes a good airport . . . operate the Tri-Pacer from fields 7500 feet above sea level at bove 75° temperature and climb right up over the mountain asses 10,000 feet high. Its ease of flying and handling in rough r are hard to believe."

says Bob Symons, famous soaring pilot and operator of Symons Flying Service, Bishop, California

When an airplane flies well at altitude, you know it will give you solid performance for all your flying requirements. That's why high praise for Piper from one of America's best-known mountain pilots is important to you when you consider buying a new airplane.

Because both the Super Cub and Tri-Pacer handle heavy loads so well at altitude, Bob Symons owns and operates both to serve mines, mills, farmers and hunters in the Sierra Nevada mountains.

"I can make landings at 12,000 feet," says Mr. Symons "on level ground and no wind with a roll of 120 yards and a take-off run of 80 to 90 yards—with a load of two people and hunting equipment. I have yet to land the Super Cub at any altitude (13,500 feet highest yet) in which the take off run was more than the landing roll."

Little wonder hundreds of mine companies, ranchers, scientific expeditions, prospectors and others with difficult flying situations rely on the 90 or 135 hp Super Cub for safe, economical, trouble-free operation. Prices start at $4,195.

With reports like this, is it any wonder that Piper outsells all others? Good proof that Piper's your logical choice too. Send today for more information.

PIPER
AIRCRAFT CORPORATION Lock Haven, Pa. Dept. K-11

☐ Please send brochure on Piper Tri-Pacer and Pacer.

☐ Please send brochure on Piper Super Cub.

☐ If under 18, send for SPECIAL brochure with photos and drawings of all Piper planes.

Name_____

Address_____

MORE PEOPLE BUY PIPERS THAN ANY OTHER PLANE IN THE WORLD

Skyways Round Table

(Continued from page 52)

and development do not understand that about 4 cents of the dollar is research and 96 cents of the dollar is development. Research expenditures in industry are often related to gross sales. "In the sub-sonic days of 20 years ago, NACA was spending about 14 cents out of every dollar that the country spent on aeronautical research and development, while in the present era NACA is spending only about 5 cents out of every research and development dollar.

"In these days of attempting to build tactically useful fighters to fight at twice the speed of sound, problems are very considerable and there is a real danger of our trying to build something we don't know how to build. A great deal of research must back up building efforts if we are really going to do the job without prohibitive costs."

Mr. Littlewood: *"You think then that the amount of money to be expended should be a function of the urgency. Obviously, the atomic energy program was under the greatest urgency, and our present military program is under considerable urgency. Those, however, are beyond the normal considerations of business. Business looks forward to the production of future dollars to justify its research efforts."*

Mr. Lear: "In making a survey, as was suggested, we ought to be specific in separating so-called romance from real business in defining research and development. Possibly a rough definition would be that research is finding out how it works, and development is making it work. We ought to have some definition there so that you can get people to thinking soundly as to whether they are spending their money for research or for development."

Can Research be Scheduled

Mr. Littlewood: *"Do you believe that research results can be stimulated by a schedule pre-applied to the determination of the facts sought, or must it be left entirely to the development of ideas without stimulation or control, hoping that something will eventually come forth?"*

Mr. Raymond: "I agree 100% with what Bill Lear has said. The term 'research' has been used loosely, and many times the figures given for research include a great amount of development work. If you could cull out the development, you'd probably find that the amount of true research going on is much less than is supposed.

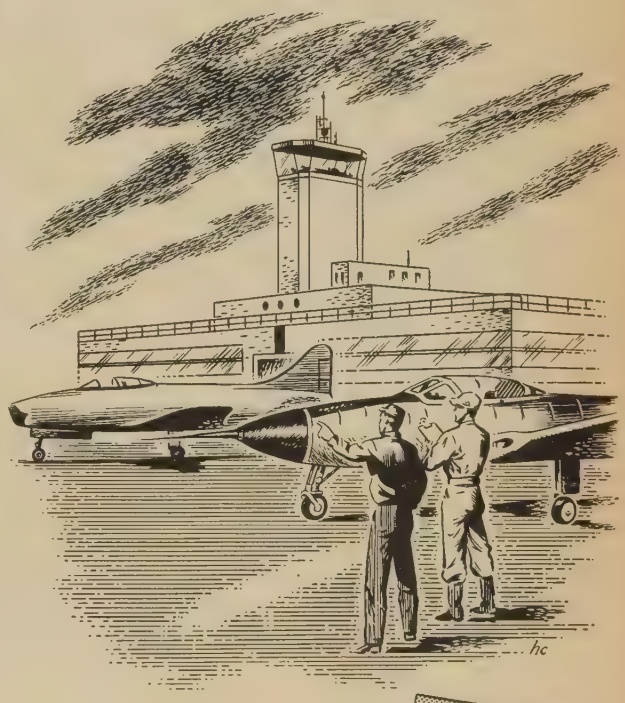
(Continued on page 56)

AVIATION NEEDS MEN LIKE YOU--

SPARTAN TRAINS MEN FOR LEADERSHIP . . . .

At this very moment, new engineering developments are being made that will open thrilling new careers for young men with vision. That's why aviation needs you! It takes young men to continue the progress in the air . . . young men to fly newer, faster planes and young men with the "know-how" to keep the planes of today and tomorrow in the air. SPARTAN, *the University of Aviation,* through intensive training courses teaches young men to become leaders. SPARTAN can do this because it keeps abreast of all new advances in aviation technology.

As strides are taken in various phases of aviation, SPARTAN incorporates them in class room studies thus assuring that all courses are fresh and up-to-date. SPARTAN instructors are skilled and experienced, professionals drawn from the aviation industry. Don't wait another day. A well-paying future in aviation awaits you upon completion of SPARTAN training. Length of training varies, depending on which course you choose.



Write for "Your Career in Aviation," a FREE fact-filled booklet that explains in detail courses offered at SPARTAN.

Spartan is approved for training under the G. I. Bill of Rights

SPARTAN
A UNIVERSITY OF AVIATION

SCHOOL of AERONAUTICS
MAXWELL W. BALFOUR, DIRECTOR

COLLEGE of ENGINEERING
ADDRESS DEPT. S-113

TULSA, OKLAHOMA

FOR COMPLETE INFORMATION MAIL COUPON TODAY

Maxwell W. Balfour, Director
Spartan School of Aeronautics Dept. S-113
Tulsa, Oklahoma
Please send your free Catalog immediately.

Name_____ Age_____

Address_____

City_____ State_____

Indicate which of these branches interests you:

☐ Flight ☐ Flight Engineer
☐ Crop Dusting ☐ Instruments
☐ A. & E. Mechanics ☐ Link Instructor

Skyways Round Table

(Continued from page 54)

"For a moment let's go back to the question of research as distinct from development. Speaking from the standpoint of industry, its interest in research is first of all founded on the fact that it provides a base on which to work in the development of a product. If industry finds there are many gaps in the research knowledge required in the development of a product to meet a presumed military requirement, it has a feeling that not enough research has been done. If, on the other hand, it finds there is plenty to start with, industry feels that research is adequately taken care of. The kind of research that fills the gaps for the development of a specific product is something that has to be scheduled. If it isn't, the product will not be completed on time."

Mr. Littlewood: *"Isn't it a human characteristic to work to a date if a date has been set, and to disregard or minimize the need for accomplishment if no date is set?"*

Dr. Dryden: "Our method in the propulsion field is to have a group that is in close contact with what is going on make a paper analysis of areas where improvements could be made that would be significant in practical development.

"As far as scheduling is concerned, no attempt is made to set deadlines. We do, however, have related mechanisms. We had a classified conference at the Ames Laboratory recently and it was surprising how the date set for that conference stimulated people to get things done. I don't think there is an absence of incentives to get things done in the basic research field."

Mr. Littlewood: *"Dr. Dryden has added a very important factor to our consideration. We've had urgency as one of the factors in determining what we'll go after, and now Dr. Dryden has suggested promise—the hope of success as being one of the things that drives us in the direction of spending such assets as are available for the accomplishment of specific objectives.*

"Capt. Condra, does an evaluation program frequently result in a completely negative answer?"

Capt. Condra: "Yes, and when it does, the item has to go back into the contractor's shops for more development. If industry has exhausted its development brains, then it goes back to the applied research group, and when that group has exhausted its thinking, it goes back into the basic research area. I think of this business of basic research, applied research, development and evaluation into the strategic requirements of the military services as a cycle. Considering the matter from such a point of view, I don't see how you can intelligently schedule anything you know so little about until you really get into the evaluation phase of the cycle."

Mr. Littlewood: *"What you are saying then is that evaluation is a feed-back to research to complete the loop, and it is necessary in order to get the most out of research and development."*

Capt. Condra: "The need to always have something better is what is pushing the research boys all the time. Those needed areas of research which we determine by evaluation also determine the amount of money to be spent, the urgency, and the importance of applied or basic research."

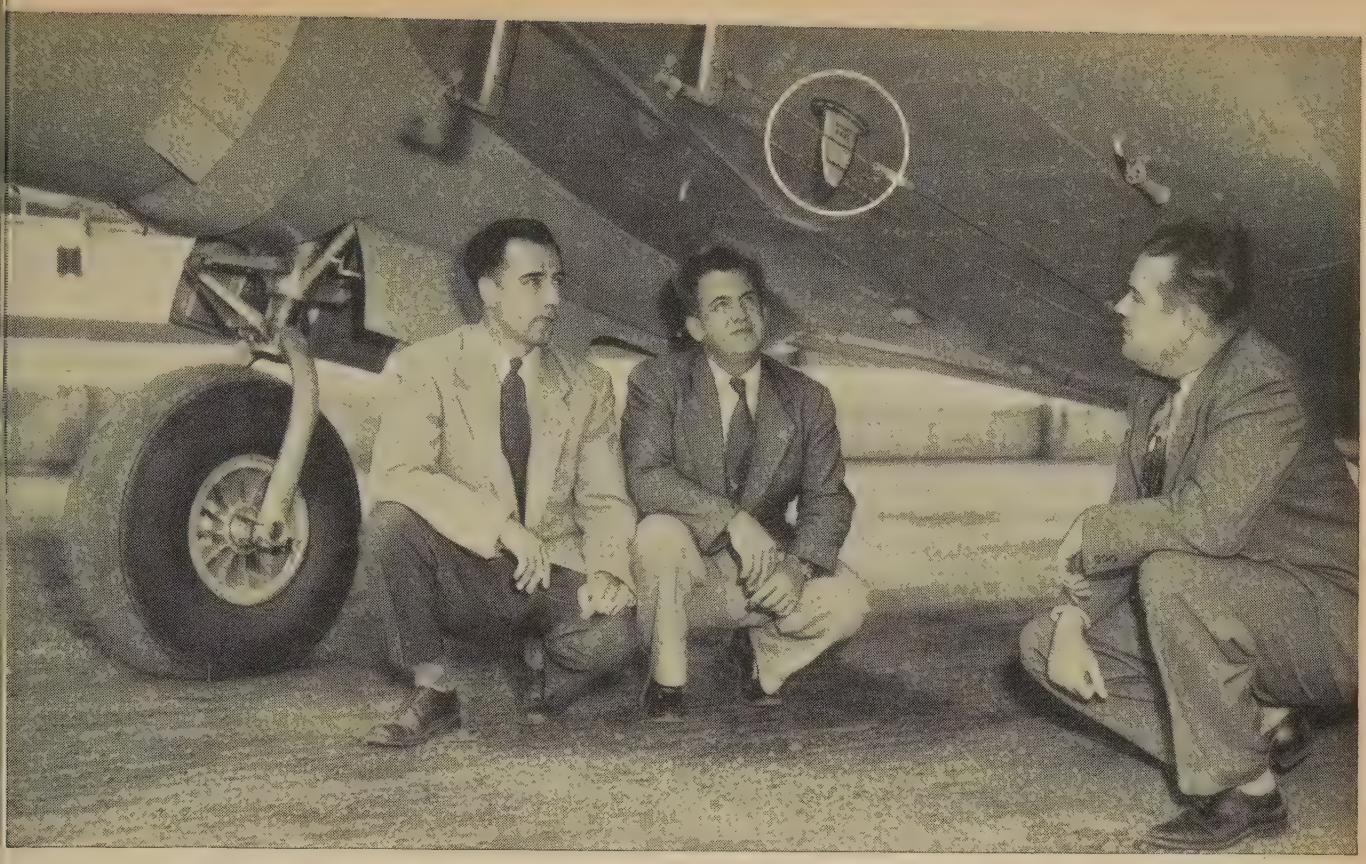
Dr. Dryden: "An example might help, Bill. The principal material that we now use for aircraft, duralumin, was actually discovered by metallurgists some time before 1910 and was being used experimentally for skin coverage on aircraft after World War I. This started research on the application of this material and it started the industrial people thinking about how much money could be made out of developing it. The result is that today it is in universal use on aircraft."

Mr. Littlewood: *"In other words, supplementary developments have made possible today the successful application of principles which were well known years ago.*

"Gentlemen, we've had some valuable generalities as to what research is, how much we should spend for it, who does it and who should do it; now, let's see what research has done and what still needs to be done in certain critical areas of aeronautical knowledge and development.

"Mr. Clarence Belinn, will you tell us

(Continued on page 58)



"DME/VOR MOST USEFUL NAVIGATION AID AVAILABLE"

...says Cole H. Morrow of J.I. Case Co.

The J. I. Case Company, manufacturers of power farm machinery, have been flying experimental DME since December 1952 in one of the company's planes. Shown above are Elmo Halverson, Chief Pilot, Paul Johns, Pilot, and Cole H. Morrow, Chief Plant Engineer, looking at the DME antenna.

Mr. Morrow, who is also Chairman of The National Business Aircraft Association says, "When all the present DME ground equipment is installed and operating, the air-borne VOR and DME will provide business aircraft operators the most accurate and useful navigation aid that has ever been available."

Bendix Distance Measuring Equipment can also help you to reduce operating costs, navigate along new or unfamiliar routes with greater accuracy, hold at unmarked points and estimate arrival times more accurately.

For additional information write:

BENDIX* RADIO
BALTIMORE 4, MARYLAND
A DIVISION OF BENDIX
AVIATION CORPORATION
Export Sales: Bendix International Division
205 E. 42nd St., New York 17, N.Y., U.S.A.
West Coast Sales
10500 Magnolia Blvd. N. Hollywood, Calif.

THE NAME Bendix AVIATION CORPORATION MILLIONS TRUST

Bendix THE MOST TRUSTED NAME IN **Radio**

*REG. U. S. PAT. OFF.

SKYWAYS FLIGHT OPERATIONS ROUND TABLE

Skyways Round Table

(Continued from page 56)

what is needed in the area of the helicopter?"

Helicopter Criteria

C. M. Belinn: (*Pres., Los Angeles Airways*): "The helicopter phase of aircraft engineering and research probably is the newest dimension of all. I can look out in almost any direction and find problems. Not long ago I talked to a very eminent engineer who stated that the last place he would think of using cycle welding, for example, would be on a helicopter rotor blade. Today, however, we have somewhere in the neighborhood of 10,000 flying hours on blades using cycle welding. As I see it, the gap that exists is in helicopter criteria. There is very little pure helicopter criteria available and we are, therefore, relying on fixed-wing criteria to an exaggerated extent. Instead of answering our problems, this merely transfers the problems to some other place.

"We think attention and research should be directed toward developing ultimate criteria applicable strictly to the helicopter, from basic research to development.

"Within the realm of mechanical design, we're interested in developing a helicopter with half as many parts, and with each part weighing half as much and costing half as much as the parts we use today. Everyone says it is impossible, but as time goes on we find it being done. Very frequently such answers come from the operators themselves. We call it 'barnyard engineering.' We decide to use a certain gadget. Someone says it's too heavy or it's too light; four or five others tell us it won't work. But we use it anyway and it works. In time the manufacturers take it up, use it, and in the end we find ourselves paying a very stiff price for it.

"Applied research today should be and probably is aimed at greater mechanical simplicity in the helicopter, supplemental power, and synthetic stability. There are many ways of providing the stability factor, but we feel it must be done in the cheapest way, payload-wise. We feel we have to have supplemental power in the rotor tips, no matter how many engines we have. We also know that we have to have what we call 'street-to-street' navigation in zero weather. The sum of all these things is automatic flight. Finally, we feel that the helicopter will be the first to achieve 100% automatic flight.

"We are all working very closely with NACA, the military, and with commercial designers, but the time lag is still too great between our plow-back time and the time the manufacturer recognizes a problem and does something about it."

Mr. Littlewood: *"You feel that as compared with conventional aircraft a substantially greater percentage of helicopter design is in the field of empirical design rather than rational design? Experience and judgment tell how to make it work; you look at it and say it's big enough or not big enough, strong enough or not strong enough; and then the proof of the pudding is in the actual trial?"*

Mr. Belinn: "I would say that is generally true. It certainly has been true in our operation. In cooperation with the manufacturer and the government, we have designed and developed a number of important components of the helicopters we use. If we hadn't provided this solution, we would have had to go out of business."

Mr. Littlewood: *"In the determination of loads of helicopter rotors, is the complexity of the mathematics involved so great that it is not susceptible to rational analysis?"*

Dr. Dryden: "Let's put it this way; no designer of a helicopter would be willing to rely solely on mathematical analysis."

Research for Air Transport

Mr. Littlewood: *"We have a vast assortment of subjects in which additional knowledge would be helpful. I'm going to ask Dan Beard if he has any suggestions to make regarding specific areas of knowledge which he feels are deficient."*

M. G. Beard (*Chief Engineer, American Airlines*): "The airlines see the need of the whole field, from basic research to the actual use of the product. There is a gap we'd like to close between the developed article and the actual use in revenue operation, namely the evaluation or what we call, service testing, so that we may know, when we put the article into use, that we have a reliable, economical and safe device by which we can transport our passengers and give value received from the tickets we sell."

Mr. Littlewood: *"Are you talking about the airplane as a whole or devices within the airplane which might affect operation?"*

Mr. Beard: "I'm talking about the airplane as a whole. We must shorten the process by which research gets down to the user. We must not only shorten it but perfect it so that the article is more usable, more reliable and safer by the time we put it into operation. Thus far, the process has gone along fairly well, because the articles we're putting into use are in a better state of development than they were years ago when air transport first became a business. But there is still this gap to be filled.

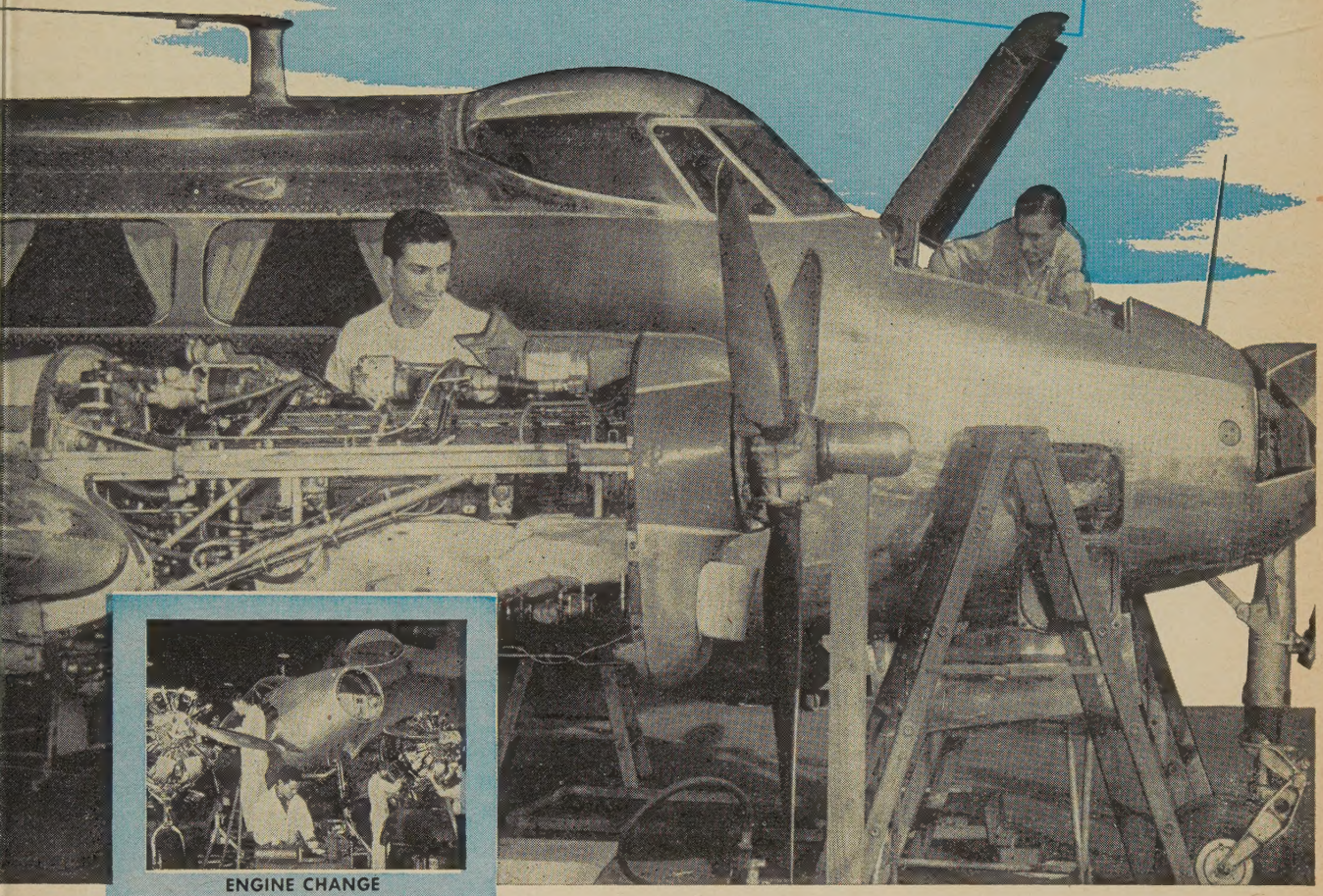
"In introducing a new article, whether it be a full airplane or an appliance on an airplane, we have to put it through some degree of service trial before we dare say, 'This is usable, fleet-wise . . . this is ready to carry passengers.' There have been suggestions that government agencies take it on, that industry groups be formed and financed to carry on service testing. I have not heard of a suggested organization that could do any better than the airlines at the present time. But there must be some way to shorten the gap in the process so that the developed article can be more readily used by the people who are going to put it into operation and make money with it."

Mr. Littlewood: *"Isn't it true that there is a most-serious expense above the cost of*

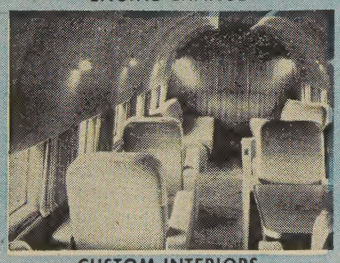
(Continued on page 60)

COVER: The twin-engine business aircraft at Williamsport Airport are (clock wise from top) Aero Commander, Riley Twin-Navion, Beech Twin-Bononza, Piper Apache and the Grumman Widgeon.

ONE-STOP SERVICE



ENGINE CHANGE



CUSTOM INTERIORS

RELICENSING OVERHAUL

EVERY JOB — MINOR ADJUSTMENT TO MAJOR OVERHAUL — IS DONE TO AVIATION'S HIGHEST STANDARDS

Whether you need a periodic inspection or a complete engine overhaul, PAC has the craftsmen and the equipment to do the job the way you want it—promptly and dependably. All component parts are restored to original factory standards.

Here at PAC's One-Stop Service Center you can get major conversions to any specifications. You can have any type of special installation—long range fuel tanks, custom interiors, edge-lighted instrument panels, or modernized picture windows.

So whatever type of aircraft you operate—commercial, corporate or executive—look to PAC... America's largest maintenance and supply company.

PACIFIC AIRMOTIVE PAC **CORPORATION**

2940 NORTH HOLLYWOOD WAY, BURBANK, CALIFORNIA

OTHER DIVISIONS: Oakland and Chino, Calif. Seattle, Wash. Kansas City, Kan. Linden, N.J.

SKYWAYS FLIGHT OPERATIONS ROUND TABLE

Skyways Round Table

(Continued from page 58)

conducting the service testing, and that is the cost of deferred use and loss of the revenue-producing value of the article until it has been service tested? Therefore, the impatience of the manufacturer and the operator is one of the incentives that gets the article into use as quickly as is reasonable and proper. Isn't it also true that plane time-testing is not in itself adequate?"

Mr. Raymond: "The only way to prove an aircraft completely would be to service test it for its entire life, which is obviously impractical. Therefore, there has to be a compromise and the compromise point we now have has been dictated by economics, by general judgment, and by the regulations as they stand. I believe some modification in the direction of additional testing may be possible to work out as time goes on. I don't think, however, it will ever be 100% in the sense of including the life cycle of every item of equipment."

Mr. Littlewood: *"The question is, how many samples should you test to determine the life cycle—as, for example, in the recent researches on fatigue?"*

Mr. Webb: "Isn't there a big personnel factor in this? Many years ago when the Navy first started its accelerated service testing, one of the things it discovered was that when several different crews flew an airplane, it got different results from each crew. I think it's a good deal like an automobile; if one person is driving the same car day after day, it usually gives good service, but if 15 or 20 different people drive that same car, you'll have all kinds of breakdowns with it."

Col. Heaton: "Because of the trend toward increased complexity of new aerial weapons which inevitably accompanies the demand for ever-increasing performance, the Air Force recently felt it had to do something to make the equipment reliable and at the same time not string out the period between the ordinary completion of development and the date it actually goes into service with the combat organizations. What we are planning on doing may seem expensive at first glance, but in the long run we feel it's going to be a great economy. Under this plan a decision to ultimately produce a weapons system is made early in the development sequence. The system is then ordered into production with sufficient lead time for delivery of first production articles shortly after first flights of hand-made prototypes. Initial production rate is slow. Aircraft delivered during this early production phase will be used for more intensive flight development tests of all components than has heretofore been the practice. As deficiencies are uncovered, remedies will be engineered and incorporated in production, a process made easier by the slow production rate. When sufficient performance, reliability and serviceability have been attained, the production rate will be stepped up for service inventory deliveries."

Mr. Marriott: (*Regional Admin., CAA*) "While that idea is an admirable way of closing this gap that Dan Beard spoke of, it wouldn't be acceptable from the standpoint of civil aircraft which are used to transport the public for hire."

Mr. Littlewood: *"Except for the legal protection afforded by the conduct of certain specified tests, are those tests the answer to assuring the safety of the traveling public? Is there any substitute for imaginative engineering, the thinking-out of all the possibilities of what might happen, and the pre-determination of whether or not the results would be catastrophic or dangerous? I'm reminded, for instance, of an experience we had in our own system. Many years ago we substituted a new oil for the oil we had been using. The new oil had been thoroughly approved after a 50-hour full power test by the engine manufacturer and was enthusiastically blessed by the oil refiner. We put the oil to work and within 24 hours we had airplanes down all over the country because the additive compound in the oil brought down the carbon which had been accumulating in the engine from the previous oil."*

Dr. Dryden: "The only way to find out whether or not a product is satisfactory is to use it in the type of service for which it is going to be used. We can run altitude tests on an engine, reproducing all the conditions we can think of, and yet if we put that engine on an airplane, we can't be 100% sure that something will not develop that we haven't thought about."

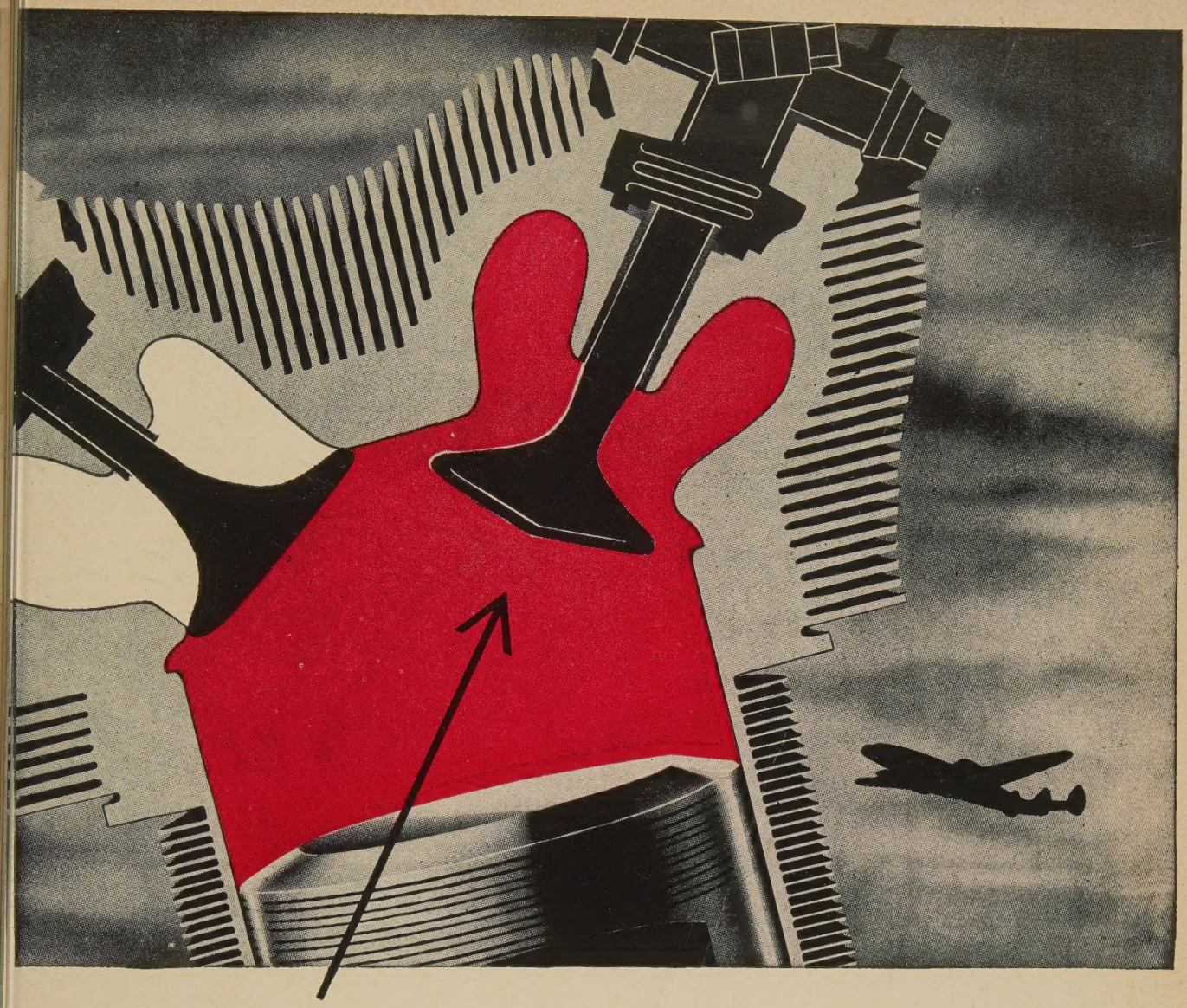
Mr. Littlewood: *"There is no 100% assurance; all we can do is make ourselves reasonably sure and then proceed from there.*

"I'd like to develop one particular area of thought which has been of great concern to me, and that's this matter of fatigue of structures. Since we have with us the Chairman of the Committee on Structures of the NACA, I'm going to ask him what is being done or should be done in the determination of the fatigue-life of flying equipment. We're getting close, I think, to design limitations with respect to fatigue capacity. There are many things coming along in the area of materials, methods of construction, etc., which might be helpful to us in determining what safeguards should be applied in that area."

Mr. Raymond: "That problem is being attacked from a number of angles, beginning with pure research which, in this instance, goes back to the fundamental physics of materials and tries to find out exactly what the mechanics of fatigue involve, and ending up with a wide variety and number of life tests of components, up to and including complete structures. In between those extremes we have the routine fatigue tests on all the various materials which are carried on according to laboratory techniques that have been developed over the years.

(Continued on page 68)

The December issue of SKYWAYS will present another section of the Airport Service Guide, which soon will be available as a separate publication. The final installment of the Air Traffic Story, previously scheduled for November, also will appear in the December issue.



This valve is a Spendthrift

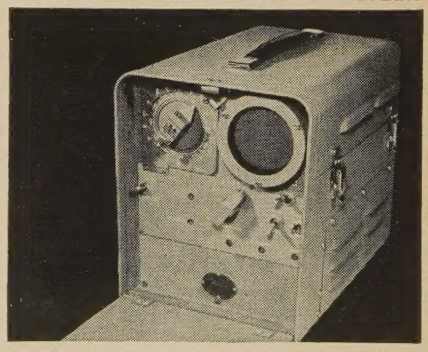
But it needn't be! Valve clearance trouble, with resulting fuel and power waste, is easily detected by the Sperry Engine Analyzer. By using vibration analysis to check each cylinder under normal operating conditions, valve clearances can be adjusted for smoother engine performance. Result . . . engines develop full power—run cooler—use less fuel—last longer.

• Vibration analysis, exclusive with the Sperry Engine Analyzer, can be employed either in flight or on the ground. When using the Engine Analyzer, valve clearance can be easily checked at each inspection and overhaul—a profitable procedure for airlines and executive aircraft operators.

• In addition to vibration analysis, the Sperry Engine Analyzer also provides detailed ignition analysis. It immediately detects, locates and identifies irregularities in aircraft power plants—either during flight or on the ground. Aside from saving ground maintenance time, the Engine Analyzer enables the flight engineer to maintain proper operating conditions at all times and prevents unnecessary component replacements.

• Our nearest district office will give you complete data upon request.

SPERRY PORTABLE ENGINE ANALYZER



ENGINE ANALYZER IS MANUFACTURED AND LICENSED UNDER JOHN E. LINDBERG, JR. PAT. NO. 2518427. OTHER U.S. AND FOREIGN PATENTS PENDING.

SPERRY GYROSCOPE COMPANY
DIVISION OF THE SPERRY CORPORATION

GREAT NECK, NEW YORK • CLEVELAND • NEW ORLEANS • BROOKLYN • LOS ANGELES • SEATTLE • SAN FRANCISCO
IN CANADA • SPERRY GYROSCOPE COMPANY OF CANADA, LIMITED, MONTREAL, QUEBEC

CLASSIFIED ADVERTISING

(Continued from page 66)

HELP WANTED (ctd)

DOUBLE YOUR PAY with a "College Equivalency Diploma". Get it by comprehensive examination at home. No classes. Free details. Cramwell, S-7, Adams, Mass.

INSTRUMENTS

NAVIGATION INSTRUMENTS: New Batori (all metal Precision Computer) Pocket size, 4⅝ inches, with Leather case and Instructions $15.00. Fairchild averaging sextants new surplus $47.50; Bausch & Lomb Sextants, new condition $49.75; Hamilton Master Navigation Watches $85.00. Dalton Model "G" Computer (new) $7.50; Weems Mark II Plotter $2.00; Dalton E-6B Computer $10.00; "New Pressure Pattern Drift Computer," $2.50; New Pan American A-2 Dead Reckoning Time. Speed, Distance Computer DeLuxe with Leatherette Case $3.00. American Airlines computer $6.00; (Free Catalog.) Pan American Navigation Service, 12021-22 Ventura Blvd., N. Hollywood, Calif.

FREE CATALOG describing famous Weems navigation aids and instruments. Send today. Weems Mark II Plotter (statute miles) $2.00 Weems Mark II N Plotter (nautical miles) $2.50; Dalton E-6B Computer $10.00; Dalton Mark VII Computer $5.00; Link Bubble Sextant $37.50; many navigation books including FLYING THE OMNIRANGE. Zweng $4.00; INSTRUMENT FLYING, Weems and Zweng $4.50; ELECTRONIC NAVIGATION. Orman $4.50; LEARNING TO NAVIGATE, Weems and Eberle $2.00; STAR CHART, Illyne $1.00; complete line of government charts and publications. Do as other navigators, pilots and students do. Select your navigation aids and instruments from the Weems Catalog. Send for it today. Address Department 9, WEEMS SYSTEM OF NAVIGATION, ANNAPOLIS, MD.

E-6B COMPUTERS, DALTON, with 30 page direction booklet, like new $4.95, with leather cases $5.45 ($10.00 value). 20% discount on lots of 12. SEXTANTS, Fairchild or link, bubble, averaging type, with carrying cases, like new $16.85. Money back guarantee. Kane Aero Equipment Co., 2308 N.E. 23rd St., Oklahoma City, Okla.

MISCELLANEOUS

$2.00 can save you hundreds. It's NEW!! Now you can receive information each month on hundreds of aircraft for sale throughout the United States. At a glance you will know what is available, hours, date licensed, price, etc., of practically every type of airplane manufactured. We tell you who own the aircraft and you deal direct, saving time, eliminating hours of travel, and by knowing the market you get the best deal possible. You can receive your first copy listing aircraft for sale IMMEDIATELY. DON'T WAIT!! Send $2.00 TODAY for a full year's subscription. Aircraft Listing Bureau, 1907 Archer Ave., Chicago 16, Ill.

AIRPORT operators send today for TAYLORCRAFT dealership information. Get in early on big expansion program. TAYLORCRAFT, INC., Conway-Pittsburgh Airport, Conway, Penna.

YOUR Leather Jacket renovated expertly. FREE circular. Berlew Mfg. Co., Dept. 33. Freeport, N.Y.

BUY WHOLESALE—DIRECT FROM US—25,000 Items, Catalog 25c. (Refundable). Matthews, 1472-VI Broadway, NYC 36.

SKYWAYS FLIGHT OPERATIONS ROUND TABLE

Skyways Round Table

(Continued from page 60)

"One of the most difficult gaps to bridge is the gap between fatigue testing under a given schedule of loads on one hand and the airplane on the other. Every individual airplane has a different life history as it goes through its various flights. The stage at which we presently find ourselves is one in which we must have recourse to a sensible inspection schedule to cover all the points that might possibly give trouble. We must have this so we can anticipate trouble before it occurs. Then we must have as large a redundancy in the structure as it is possible for us to design into an aircraft, so that in the event fatigue failure occurs, it will not be catastrophic. We have been following that principle for a number of years and, on the whole, the service experience has indicated that it is good."

Mr. Beard: "It strikes me again that a service test is never completed, just the same as development is never completed, or research is never completed. It's a continual process and by actual use we are service testing continually. We are finding out the limitations of devices and how to use devices safely and efficiently. The aircraft operator is part of the feed-back circuitry that goes back to basic research."

Mr. Littlewood: *"Am I correct in understanding that an hour limit should not be set on an airplane with respect to its fatigue life; that we should have practical continuing methods of determining the existence and progress of fatigue failures so that we can out-guess them; that the original design and construction should guard against the onset of such failures; and that the determination of the adequacy and suitability of equipment before we use it should not be too long deferred in a preliminary test period, but should be continually pursued throughout the use of the equipment?"*

Systems Engineering

Capt. Condra: "As I understand it, the question is how can we shorten the evaluation phase to make an airplane safe, from Mr. Beard's point of view, as a transport. I feel there are definite ways of shortening that period, and I don't mean by a reduction in specifications. I believe that industry and the military have been weak on systems engineering. We don't do enough of marriage of components and parts before we get them into an end product. We don't do enough simulation testing. In the missile business, for example, it's obvious that we can't expend a missile everytime we want to test a component or system. We must employ simulation programs early in the game in order to develop serviceability of a missile which has to be on its own after it is launched. In the past three years, the missiles contractors, the aircraft, engine and equipment manufacturers have progressed some distance in the direction of simulation testing and systems engineering. There is still a long way to go, but I believe it has shortened the evaluation period appreciably. People are beginning to realize that a lot can be done on the ground, at low cost and quicker. The concern or source of worry is not so much in major-strength parts failing, such as a wing falling off, but rather in the components and the accessories—the little 15¢ tubes, etc. It's the unreliability of the small pieces, trying to use existing equipment or components of questionable reliability in a highly developed end product."

Mr. Lear: "Dan Beard has posed a requirement and I agree that there is a possibility of aiding and accomplishing the shortening of this time of perfecting an airplane to the point where it is safe *if* the operating people would assign perhaps 1,000 pounds of usable load of that airplane to complete instrumentation for the first period of time that the airplane is in use. These instruments would graphically record all the imagined variables that can occur so that they could be studied at leisure at a later time."

Mr. Littlewood: *"That's an interesting suggestion and is, I think, supplementary to my thought of imaginative engineering as an important element of proving and preventive testing."*

Col. Heaton: "We've done quite a bit of this instrumenting of early aircraft to determine what actual loads are at various points of structure. The only thing here that I'd like to emphasize is that I don't think it is accurate to use the word, 'complete' instrumentation. Instruments aren't placed at random. Sufficient instrumentation should be installed to measure stresses at structural points which engineering analysis suggests may be subject to higher loads than their design values."

Mr. Beard: "Over the past years the operators have cooperated with the manufacturers and the NACA on instrumentation. For example, since the war, there have been VG recorders carried in airline operation on almost every model post-war transport plane so that NACA and manufacturers' metallurgists, structural engineers, etc., can get certain information about gust loads that are encountered in year-round operation. Ice secretion meters and rain meters have been installed on airline transports to get meteorological data on the icing rates and rain intensities encountered throughout the year. More of this could be done without great effort on the part of any one operator or any one agency. This information is fed back into the basic research area, and is a very constructive part of the process in the over-all evolution of the modern air transport."

Mr. Littlewood: *"Gentlemen, we've only had time to develop a few specific thoughts in this vast area of research, development and evaluation. Certainly the subject is almost unlimited in scope. But we have, I feel, developed some interesting and potentially helpful thoughts on what aeronautical research development and evaluation are; who does or should do them; and how much of such activities are appropriate.*

"Our development of specific problems and areas of needed research has been all all too limited by time, we hope to explore the subject further at some future SKYWAYS' Round Table."